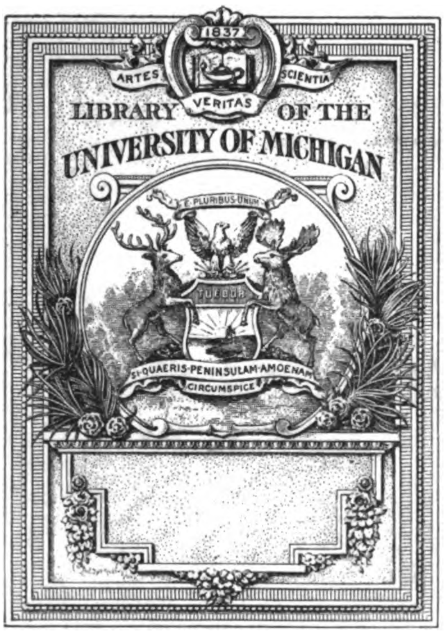
Annual report of the Pennsylvania Department of Agriculture

Pennsylvania. Dept. of Agriculture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THIRD ANNUAL REPORT

OF THE

PENNSYLVANIA

DEPARTMENT OF AGRICULTURE.

PART I.

1897.

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA.
1898.


VIRTUE LIBERTY AND INDEPENDENCE

OFFICIAL LIST.

THOMAS J. EDGE, *Secretary*,
Harrisburg, Dauphin County.

JOHN HAMILTON, *Dep'y Sec'y and Director of Farmers' Institutes*,
State College, Centre County.

OLIVER D. SCHOCK, *Chief Clerk*,
Hamburg, Berks County.

JAMES B. MERSEREAU, *Stenographer*,
Harrisburg, Dauphin County.

WILLIAM DENUES, *Messenger*,
York, York County.

LEVI WELLS, *Dairy and Food Commissioner*,
Spring Hill, Bradford County.

GEORGE G. HUTCHISON, *Clerk*,
Warriors' Mark, Huntingdon County.

Dr. B. H. WARREN, *Economic Zoologist*,
West Chester, Chester County.

Miss MAY V. RHONE, *Clerk*,
Centre Hall, Centre County.

Dr. J. T. ROTHROCK, *Commissioner of Forestry*,
West Chester, Chester County.

ROBERT S. CONKLIN, *Clerk*,
Columbia, Lancaster County.

Dr. LEONARD PEARSON, *State Veterinarian*,
Philadelphia.

1--6--97

LETTER OF TRANSMITTAL.

COMMONWEALTH OF PENNSYLVANIA,
DEPARTMENT OF AGRICULTURE,
HARRISBURG, PA., January 1, 1898.

HON. DANIEL H. HASTINGS, GOVERNOR,

DEAR SIR: In compliance with the requirements of sections second and sixth of the act of March 13, 1895, I have the honor to herewith present the third annual report of the Department of Agriculture, and in so doing would take the opportunity to acknowledge with sincere gratitude the hearty co-operation which I have received from yourself and from the heads and officers of the various divisions over which you have assigned me control, and remain,

Very respectfully,
THOS. J. EDGE,
Secretary.

DEPARTMENT OF AGRICULTURE.

REPORT OF THE SECRETARY.

GENERAL WORK OF THE DEPARTMENT.

The past year has been one of advance all along the line of the work falling under the care of the Department, and, except possibly in a few minor instances, we find the work in advance of its position at the same time one year ago. The efficiency of the farmers' institutes has been increased by the additional amount appropriated for this purpose by the Legislature; the work of the Dairy and Food Commissioner has been extended by the passage of acts relating to cheese, vinegar and preservalines; the Forestry Commissioner has been strengthened by a special appropriation which will enable him to more efficiently carry on the duties imposed by the act of March 13th, 1895; the State Veterinarian, through the State Live Stock Sanitary Board, has been enabled to not only increase the efficiency of his work, but to also greatly extend its scope and usefulness by a special appropriation for an investigation into the preventable diseases of animals, and also by the authority given by the Legislature to exercise control over milk cows and breeding animals brought into our State, and to thus shut out diseased animals which ultimately would prove, under our existing laws, a burden and an imposition upon the Live Stock Sanitary Board.

The results and effects of the different acts which the Legislature of 1897 placed upon our statute books, and the proposed manner of carrying them into effect, will be distinctively noticed in their appropriate places in this report, and I need only here allude to them by the statement that, in effect, this additional legislation has about doubled the duties of the Dairy and Food Commissioner without any increase in the amount of funds accorded to him for expenses.

An item of great importance in the work of the Department, which is made more evident each year, is its educational feature as is shown by the correspondence of the officers and by the advanced ideas and views as noticed at our farmers' institutes, and I regard this as among the most important work, and the results achieved during the past year are of the most encouraging character.

Our farmers much better understand the intent and object of the Department and its officers, and are rapidly realizing that in it they have a department essentially their own and for their own benefit, and that if they do not receive the full measure of this benefit, the fault is their own, and does not revert to the Department or its officers.

Every division of the Department has a work to perform which, when properly appreciated by our farmers, will more than repay the cost of all of the divisions. Thus the work of the analyses of commercial fertilizers much more than repays the whole cost of the Department; the benefits obtained from farmers' institutes, especially in localities where they are properly understood and taken advantage of, more than repays the total expenses incurred in supporting the Department; the benefits gained by the work of the State Live Stock Sanitary Board, who, with the exception of the Governor, are all officers of the Department, in its work of suppressing tuberculosis, glanders and other contagious diseases, has been the means of saving live stock of much more value than the entire cost of the Department, and the work of the Forestry Division, in educating the people of the State and members of the Legislature which rendered the forestry legislation of the last session possible, will also more than repay the outlays on account of all of the work accomplished by the Department during the year.

The general correspondence of the Department has been greatly increased during the past year, and its value as a source of information to farmers thereby greatly extended. The Secretary has, so far as possible, retained this feature with his special care and, while all matters specifically related to the sub-divisions have been referred to their heads, yet the correspondence of a strictly general nature has been large, and it is believed that in this manner we have been able to confer lasting benefits upon the farmers of the State.

During the twenty-one years in which this correspondence has been under my care, a gradual and healthy change has taken place in its character, a change which clearly shows that our farmers are thinking more for themselves and depending less upon what is told them by those who too often have other interests more deeply at heart than those of the people whom they claim to represent.

We find that our farmers, largely through the avenues opened up to them by the Department of Agriculture and the Experiment Station, are doing more progressive thinking and acting than at any time during the past two or three decades and it is believed that, as the work of the Department progresses, this education will make itself increasingly felt, and that corresponding benefits will accrue which will show the wisdom of the act creating this department of the State Government for the benefit of the farmer.

FARMERS' INSTITUTES.

In 1859, the Massachusetts State Board of Agriculture appointed a committee "to consider and report upon the propriety of institute meetings similar to teachers' institutes;" this appears, so far as can be ascertained from existing records, the origin of the movement for farmers' institutes in the United States.

During the same year the committee reported strongly in favor of the proposed institutes, but no definite action appears to have been taken until 1871, when the committee recommended that all agricultural societies having representatives in the Board should "be requested to organize an annual meeting for lectures and discussions." In February, 1878, the Massachusetts Board of Agriculture held a series of three meetings, which were known as "farmers' institutes of Massachusetts;" in 1880 the Secretary of the Board was directed to "attend as many farmers' institutes as the other duties of his office would permit." In 1889, the Massachusetts board made it obligatory upon every society having a representative in its membership, to hold institutes, and in 1880 the reports show that 36 societies represented in the board had held 129 institutes.

In 1861, authority was given the Michigan Board of Agriculture to "institute a winter course of lectures for others than students of the State Agricultural College, under necessary rules and regulations," and its is claimed by some that these were in reality the first farmers' institutes held in the United States.

In 1869, it appears from the reports that, supported by local contributions, Profs. Welsh, Roberts and Bessy, assisted by Mrs. Tupper, held farmers' institutes in Iowa, and the report of 1871 contains a full account of the proceedings of these institutes.

In 1842, the New York State Agricultural Society instituted a course of winter meetings which, in many respects, resembled farmers' institutes of the present day, and, six years later, the society, by unanimous vote, resolved to continue them.

An examination into the history of the movement for farmers' institutes in Pennsylvania shows that much confusion has existed as to the difference between meetings of the farmers' clubs and the farmers' institutes of the present day, and authorities vary greatly in their views upon the question, but a majority agree that the main difference is that the meetings of the farm clubs are supported from private sources, while the expenses of the farmers' institutes are paid by the State.

If we accept this definition, and I find no better point at which to draw the dividing line, it follows that the first Pennsylvania farmers'

institute was held by the State Board of Agriculture, May 22d, 1877, and that this body has annually maintained them up to the transfer of the work to the Department of Agriculture, in 1895.

From May 22d, 1877, to June 22d, 1885, the Board of Agriculture maintained its farmers' institutes, necessarily limited in number, from its funds for general purposes, but, their value having been demonstrated to the satisfaction of all concerned, the Legislature, in 1885, made a specific appropriation of $1,000 per year, for two years, "for the actual and necessary expenses of conducting local farmers' institutes," and this may be justly claimed as the primary appropriation directly for this purpose. Since the latter date annual appropriations have been made to the Board of Agriculture as follows:

1885-6,	$1,000
1886-7,	1,000
1887-8,	3,000
1888-9,	3,000
1889-0,	5,000
1890-1,	5,000
1891-2,	7,000
1892-3,	7,000
1893-4,	9,500
1894-5,	9,500

These appropriations were expended by the Board in holding institutes as shown by the following table:

1885-6,	13 institutes,	23 days.
1886-7,	18 institutes,	30 days.
1887-8,	46 institutes,	81 days.
1888-9,	54 institutes,	96 days.
1889-0,	82 institutes,	144 days.
1890-1,	69 institutes,	121 days.
1891-2,	84 institutes,	166 days.
1892-3,	85 institutes,	168 days.
1893-4,	139 institutes,	258 days.
1894-5,	110 institutes,	205 days.

From June 1st, 1895, until the present time, the Legislature has made the following appropriations to the Department of Agriculture for the specific purpose of holding farmers' institutes:

1895-6,	$7,500
1896-7,	7,500
1897-8,	12,500
1898-9,	12,500

These appropriations having been made for periods of two years, we can, in considering the results, only reach conclusions by taking the two years' work as a whole and considering it as for one period, and, inasmuch as the second period of two years under the management of the Department has but fairly commenced, we can only judge its results by the work as outlined by Prof. Hamilton, in his Institute Bulletin for the past autumn.

For the period from June 1, 1895, to May 31, 1897, (two years), Prof. Hamilton reports that the amount of the appropriation, $15,000, was divided between the local expenses and the State lecturers in the proportion of $6,891.93 to the local managers for local expenses and $8,108.07 to State lecturers and for other expenses of management. The report also shows that during this time 572 days of institutes were held, the actual expenses of which were $26.00 per day, of which $12.00 per day was used for local expenses, and $14.00 per day for State lecturers and other similar expenses not local.

The experience of the Department having been that, previous to this year, its institute season had commenced too early in the fall and continued too late in the spring to secure the maximum of attendance, Prof. Hamilton decided to increase the number of institute corps from three to four, and to so arrange dates that the present season should commence November 29, 1897, and end March 8, 1898.

In order to make the holding of these institutes practicable, the force has been correspondingly increased and strengthened in various ways, until it is now believed that our State has one of the most thorough and practical corps of institute workers in the United States.

During previous seasons a portion of the appropriation has been set aside for the use of local managers for the payment of strictly local expenses, such as hall rent, advertising, board and expenses of local speakers, etc. During the season of 1896-7 this amount was $9.00 for each day of institute held. The experience of the last season having proven that this amount could be profitably increased, the sum of $12.50 per day of institute has been set aside for the local expenses.

In his official bulletin of institute information, Prof. Hamilton thus alludes to the mode of apportioning the funds among the different counties, and also among the different local institute managers:

"The apportionment shows the number of days that the Department will furnish two lecturers in each county for institute work during the season of 1897-8. It is made on the basis of two days to every county having not over 1,000 farms; three days of institute to every county having more than 1,000 farms and not over 1,500, and afterwards one day for each 1,500 farms, or fraction thereof, additional. This secures Department aid in each county in proportion to its agricultural interests.

"The amount of money to be distributed to the various managers for

local purposes, will be according to the number of days of institutes held. In order to make the amount ample for the coming season, the sum has been increased to $12.50 per day of institute. This provides $25.00 for each two days of institute, to be used for local expenses, and there will be, in addition, the State aid of at least two lecturers which, with the local assistance, ought to carry the work through in a creditable manner."

In some neighborhoods we find that owing to the existence of farm clubs and granges, the farmers of the locality are competent to organize and carry on independent institutes or farmers' meetings without the aid of the Department and its force. It has been our desire to encourage this condition as much as possible, and I am strongly of the opinion that such clubs should be formed in all strong agricultural centres, and the Department relieved from institute duty there in order that its influence and assistance may be extended in other districts in which they are more needed, and where farmers are less in the habit of meeting together for the discussion of agricultural topics.

When managing the institutes under the care of the Board of Agriculture, it was always my rule to encourage the formation of permanent organizations having for their object the holding of regular meetings for the consideration of questions best suited to the interests of the farmers of that locality, and I fully believe that such clubs or organizations may profitably be established in every agricultural community in the State. In districts in which strong and active granges or alliances already exist, they will and do serve as the neuclus around which the agricultural interests of the neighborhood may gather, and where such organizations do not exist, they should be formed, and it will, at all times be a pleasure to the officers of the Department to assist in the establishment and maintenance of organizations of this character, and it will also be considered the duty of the Department, when it is possible, to extend assistance, in the form of speakers, to such meetings.

It is noticed that in many districts there is too strong a disposition to depend upon State speakers alone, and not to make sufficient provision for local help in making up the programme. This is a grave error, for there are in all communities those who are fully capable of intelligently discussing the questions which most interest that locality, and one of the main objects and benefits of farmers' institutes is that they educate the leading members of the district up to an ability not only to interest their audiences, but also to make them fully competent to manage and carry on the meetings themselves.

DIVISION OF ECONOMIC ZOOLOGY.

The fire which destroyed the State Capitol was disastrous for this division of the Department of Agriculture, and its chief, Dr. B. H. Warren, lost a portion of his private library, note books and statistics which had been collected with considerable labor during the preceding year.

Dr. Warren reports that during the past year he received 357 specimens (embracing 39 species), of insects, which were sent by farmers and others for identification; in addition to these, his report states that 78 specimens of birds, of 45 different species, were sent in and identified by the division.

Considerable attention has been paid to the collection of data and information relative to wild animals destroyed by forest fires, and to the loss by the destruction of birds and their nests by the same agency.

The attention of Dr. Warren having been called to the increase in the amount of bounties paid by different counties in the State, he has collected, and will embrace in his annual report, a large amount of statistics relating to this economic question so little understood, and to the too often foolish payment of money in the form of bounties for animals and birds which in reality are the friends of the farmer, and which should be preserved in order to retain that balance of power which nature has established between the crops and their insect enemies, and which is so often disturbed, to the great loss of the agriculturist, by the destruction of insect-eating birds.

In the line of special investigations the force of the division has been directed to the following topics:

1. Field mice and best methods for their destruction.
2. Grasshoppers, and how to get rid of them.
3. Lice and other insects which annoy cattle.
4. The English sparrow and its relation to agricultural interests.
5. Currant, grape and gooseberry destroying insects.
6. The wheat weevil and wheat midge.

In the investigation into the habits of the English sparrow and its effects upon agricultural interests, a large number of circular letters of inquiry have been sent out and replies received from farmers and others interested. The Zoologist and his assistants have made a number of examinations of the stomachs and other organs of this sparrow, and have, in this manner, been furnished with evidence as to the character of its food and the effect which it, either directly or indirectly, exercises upon the agricultural interests of the State.

FORESTRY DIVISION.

The Forestry Division, under the energetic leadership of Dr. Rothrock, has, within but little more than two years, taken a position well towards the front of all states which have by legislative action shown an interest in matters relating to forestry, and, if the balance sheet is to be made up from laws actually upon the statute books, it is a question whether Pennsylvania does not occupy the foremost position in all questions which relate to the preservation of her forests and the reforestration of her cleared lands.

When this division was created, it had entirely new ground to operate upon, as the citizens of our State had not had the subject of forestry brought before them except in a spasmodic manner, by which but little real good was accomplished. Many had the idea that any move in the interest of the preservation of our forests or for the reforestration of denuded areas must necessarily conflict with the pecuniary interests of the owners of these areas, and that the systematic preservation of our forests meant the prohibition of the cutting of timber by their rightful owners.

Commencing thus upon really negative ground, Dr. Rothrock has changed this view not only among the owners of timber lands, but also among members of our Legislature until it is generally understood that the interests of the State as to forests need not in any manner conflict with the interests of the owners. It is a conspicuous fact that thus far, in the already large collection of laws relating, directly or indirectly, to the interests of forestry, there is not a single provision to be found which is not in the interest of the forest owners as well as the State. It is true that at first glance it may seem that some of the provisions of laws enacted by the last Legislature appear to react against the interests of the owner, but a careful examination and the results of the future, will clearly show that this is not the case.

Recognizing the fact that the greatest enemy to reforestration has been the forest fire, the Department has used its best efforts to educate the people up to a true understanding of the question, and to show them that the theory that railroads are the main causes of these losses is not correct, but that careless hunters, boys and similar preventable causes, create more loss than do locomotives and all other causes combined.

Two acts bearing directly upon this phase of the question were made laws during the session of 1897. One makes it the duty of constables to act as fire-wardens, and the other increases the responsibility of county commissioners in the same direction, and it is believed that, coupled with a healthy and correct public sentiment, that both of these measures will decrease our annual losses from forest fires.

Another step in the same direction was secured by the passage of the act which authorizes all peace officers to arrest, without warrant, such persons as may be guilty, either through carelessness or design, of causing fires in forest areas. It is true that by some, this step is regarded as dangerous and possibly not warranted by custom or precedent, yet it is believed that it will, when supplemented by other legislation, effect much good.

An act was drafted by this division providing that all unseated lands and lands sold for taxes should become the property of the State for the formation of forest reservations, which shall assist in the protection of the headwaters of our streams and water courses, the theory being that as now situated they are totally unproductive and that, under the provisions of the act, they will not only in time become productive, but will also materially assist in the restoration of the balance required by physical laws which have too long been violated.

The Forestry Division, assisted by the Department and its other sub-divisions, has also secured the enactment of a law which partially relieves forest lands from taxation and which, in a similar manner, encourages the intelligent care of cleared lands by which the growth of valuable timber is encouraged and rendered possible.

The passage of the act of May 25, 1897, probably constitutes the greatest achievement of the Department in the direction of forest protection and water supplies. It was at first met with strong opposition because its merits and intentions were misunderstood, but after it had been thoroughly explained to our people through the medium of farmers' institutes and to the Legislature through its proper committees, nearly all opposition was removed, and it is safe to state that appropriations and investments made by the State, under the provisions of this act, will prove to the citizens of the future the most profitable investment that could have possibly been made, and, as its operations are founded upon one of the most solid of all theories relating to the interests under the care of the Forestry Division, it is not too much to say that, if properly supported by subsequent legislation, our State will soon take the foremost position with her forest reservations and the protection of her water supplies; and it is, indeed, fortunate that the location of the head waters of our main streams is such that three reservations, if of sufficient size, will effect the same results that would require many smaller ones in other states.

In bringing the subjects under his care to the attention of the public and especially to that portion most deeply interested in agriculture, the Commissioner of Forestry has had a powerful aid in the extensive series of farmers' institutes which have been held in every county of the State during the past three years, and he has made use of this potential influence for good by delivering more than fifty illustrated lec-

tures in various portions of the States, and others in surrounding states where his services have been asked, and it is needless to add that these lectures have had much to do with forming public opinion into such a condition that has rendered the legislation above alluded to not only possible, but also popular.

The destruction of the special report of this division by the burning of the State Capitol was a misfortune, but the almost unanimous passage of an act of the Legislature for reprinting it, furnished but another proof of the fact that an unusual and lasting interest has been awakened in our State on this subject.

The special report of Dr. Rothrock shows that the division has over 1,500 practical correspondents, and that a large number of blanks have been sent out asking for information relative to the amount of timber which has been cut during the year, the condition and value of that left standing and for information upon other topics relating to the forest interests of our State, and the replies already received to these circulars of inquiry clearly prove that Dr. Rothrock will be able to lay before our next Legislature information of such a practical character as will relieve the division from any mistaken criticism and show the wisdom of the legislation secured last winter.

Arrangements have been made to secure special reports from experts in relation to the relations of our forests to water powers which, owing to the rapid introduction of electricity as a power, are annually becoming more valuable and more worthy of protection. The study of the various fungi which causes more or less loss to our forests, shade and fruit trees has also had the attention of the division, and it has been the pleasure of the Department to heartily co-operate with Dr. Rothrock in this special direction.

At several times during the past year, the attention of the Department has been directed to the loss of shade, fruit, forest and ornamental trees from the exhalations of mines and certain manufacturing industries; this subject has been referred to Dr. Rothrock and his assistants, and his forthcoming report will, I am sure, deal with the problem in a manner which will prove satisfactory to all concerned, and will enable the Legislature, if action is necessary, to act intelligently in relation to the subjects involved.

The following quotation from a friend of the forestry cause in our State is so appropriate that I transfer it to my report as conveying my own sentiments:

"The division is young. It deals with problems hitherto new and unsolved in our Commonwealth. It is safe to assume, however, that the magnitude and importance of its operations will become more and more apparent with each successive year, and that henceforth it must be considered as an essential factor of our State Government."

DAIRY AND FOOD DIVISION.

The work of the division under the control of the Dairy and Food Commissioner has progressed steadily, but it is greatly to be regretted that a lack of funds has more or less crippled the performance of certain duties pertaining to the office. The annual appropriation of $12,500 is too small to accomplish the work devolving upon the division, especially as each succeeding Legislature has, by the enactment of new laws, added new and expensive duties without a compensating increase in the amount appropriated for expenses.

When the Legislature devoted the fines collected to the expenses of the Commissioner, it was no doubt under the impression that it was adding largely to the income of the office, but it was not then, as it is now, understood that the fines collected in the average suit are not equal to the salary and expenses of the special agents, lawyers and chemists necessarily employed, nor was the fact taken into consideration that he fines from various acts delegated to the Commissioner for enforcement would naturally decrease as the public became acquainted with the provisions of the act, and that the adulteration of all articles of food would gradually decrease, but that this decrease, while it materially diminished the amount of fines collected, would not be followed by any material decrease in the expenses of enforcing the laws, inasmuch as the same number of special agents would be required and the same amount have to be expended in their travelling and other expenses.

During the past year this division has kept an average of seven special agents steadily at work inspecting the various articles of trade specified by the acts of the Legislature, and during a portion of the time ten agents have been at work. The proper enforcement of the laws relating to articles of food has also required considerable expenditure for legal advice and assistance in bringing suits, settling points involved in the construction of the various laws, and in the payment of chemists for the analyses of samples furnished by the special agents.

In order to economize in the direction of costs of attending suits, the Department has appointed five chemists and has thus been enabled not only to economize in expenditures, but has also been able to push the work forward with greater rapidity and certainty, and has been placed in a position in which its work can give better satisfaction to those most directly interested—the consumers and retail dealers.

The effect of the various pure food laws, and especially of the one relating to food products, has been very evident, and the progress

made in clearing up the trade and in substituting first class articles for adulterated ones, is so plain that even those who were at first opposed to the provisions of the law when it left the care of the Legislature, are now among its best friends and are loudest in their praise of its effects.

Although this act has been in force practically but a little more than two years, the effect of its enforcement, as shown by the shelves of the average grocery store, is very evident. When the Commissioner commenced the enforcement of this special act, Pennsylvania was the dumping ground for all kinds of adulterated goods. Surrounding states all had done more or less to clear up this objectionable condition of affairs, and as a natural result, our State was receiving more than her share, but an examination now of any town or city in the State will clearly show the effects of the work already accomplished, and possibly prove to the observer that more may yet be done in the same direction.

The special agents have been carefully instructed as to their duties, and informed that the enforcement of the various laws did not mean a crusade for the recovery of fines or for the punishment of those who innocently disobeyed the provisions of the law and were only technically guilty. The agents were clearly instructed by the Department that the pure object of their work was to secure the enforcement of the law, and that the plan which accomplished this result with the least loss and trouble to those directly interested, was the best and the one most desirable. As a result of this construction of the law, which was fully endorsed by the Attorney General, the Department has reserved the right to review the finding in a number of cases in which it was clearly proven that the defendants were innocent of any intent to evade or defy the law, and that articles which had been found among their stock as adulterated were purchased by them in good faith.

In a number of cases in which the retail dealer has been found guilty of a violation of the laws relating to pure food, and it was clearly proven that he was not aware of the character of the article sold, a compromise has been made upon his furnishing evidence for the prosecution of the wholesale dealer from whom he purchased the goods.

One of the most evident effects of this mode of procedure has been a healthy change in the manner of making purchases, and the adoption by the retailer of the habit of demanding written guarantees from the wholesaler as to the character of the goods purchased. The enforcement of these acts has also caused the formation of associations of dealers in the same or similar lines of trade in nearly all of our larger cities and towns. These associations, in many cases, employ a chemist, and have all doubtful goods tested, and also apply to the Department for written rulings as to branding, marking, etc., and it is a

matter for congratulation to the Department that every change thus far made by the retailer in his mode of buying has been directly in the course of protecting the interests of the consumer as well as his own.

The benefits conferred by the Department in the enforcement of the several food laws cannot be estimated with any degree of certainty, and our only method of reaching even approximate results is by comparison with other states in which similar laws have been in force for a number of years.

Dr. Abbott, of Massachusetts, estimates that in that state the enforcement of food laws have annually saved its citizens not less than $41,250,000. Dr. Neal, formerly Dairy and Food Commissioner of Ohio, estimates the saving in his state from this source at $7,280,000. The experts of the National Department of Agriculture estimate that the proper enforcement of pure food laws will save the average community not less than fifteen per cent. of the cost of their food products.

Each year's progress shows that, taking the same number of samples as a basis for the calculation, the number of adulterated samples falls off quite rapidly, until, even after the lapse of but a little more than two years, we find that they have fallen off to a degree which is plainly noticeable, not only in the work of the Department, but also in the appearance of the goods on the shelves of the stores in all of our principal cities and towns, and that this effect is rapidly being extended to the smaller villages of the country districts, and that, where plain adulterations were sold two years ago, other goods have been substituted or the lower grade goods labeled so as to conform with the requirements of law.

Many hold the opinion that adulterated articles have been largely driven from the market. This is an error, for there are numerous low grade and adulterated goods which can be legally sold, and, indeed, the intention of the pure food law was not to prevent the sale of such articles, if they contained nothing injurious to health, but to enable those who wanted and were willing to pay for pure goods to obtain them, and at the same time open the market, under proper restrictions, to lower grade goods.

Thus, substitutes for coffee, which contained no genuine coffee, whatever, are legally sold, not as coffee, as was the case previous to the enactment of the law under consideration, but as "imitations" and mixtures," so that the purchaser who wanted a pure article of coffee has been secured the privilege of purchasing it openly and surely, and at the same time the right of other citizens to purchase cheaper and lower grade articles has not been curtailed but merely regulated and restrained so as to protect other buyers.

Two years ago the shelves of many groceries were filled with numerous imitations which were sold in close competition with the genuine

article, and often sold as absolutely pure, but these are now sold only for what they really are. Glucose, with a small piece of genuine honeycomb in the jar, as an evidence of the purity of the supposed honey, may still be sold, but not as genuine honey, and the same rule may be followed all through the trade in articles covered by the pure food laws, the enforcement of which has been delegated to the Department.

During the past year the agents of the Department have been brought more or less in contact with samples of ground mustard to which quantities of starch had been added. In some cases this addition has been conclusively shown to amount to the extent of seventy per cent. In one case of this kind, the Department officers were practically non-suited, although adulteration with starch to the amount of seventy per cent. was clearly shown and practically admitted, on the plea that mustard was not a "food" within the meaning and requirements of the Pure Food act, and that, therefore, conviction could not follow. The correctness of this position is controverted by all cases tried under the much older English Food laws by which everything, except baking powder, which enters into the composition of food, is considered as "food" within the meaning of the law and adulterations and substitutions severely punished.

The Legislature of 1897 very materially added to the duties of the Dairy and Food Commissioner by the enactment of a law regulating the branding, grading and sale of cheese, and by the provisions of the vinegar law, which includes all kinds of vinegars sold, or offered for sale, in the State. The previous act relating to vinegar was confined exclusively to cider vinegar and to fruit vinegars.

To carry out these two acts in a thoroughly effective manner would require the united service of all of the special agents now employed by the Department, and would thus leave no funds or agents for the enforcement of other and quite as important laws. This fact plainly shows that the appropriation made for this division is out of all proportion to the work demanded of it, and that it should be increased at the first opportunity. It is utterly out of the question to expect the Dairy and Food Commissioner to enforce all of the laws relating to pure food, vinegar, cheese, lard, oleomagarine and other adulterated food products with but seven special agents to patrol the whole State, when other States make use of a larger force for the enforcement of a single law.

The work of the Department in the direction of regulating the food supplies of the State has met with the hearty co-operation of all classes interested. Those who, at first, were disposed to throw obstacles in the way of enforcing these laws have become our hearty supporters, and in our work we repeatedly receive assistance and information from those in the trade, which enables us to more economically

enforce the laws and at the same time secure a more general application of the various decisions made and distributed among dealers, some of whom have, through their associations, even gone so far as to print, at their own expense, the decision of the Attorney General and of the Department relating to important points in the construction of the laws under consideration. There is scarcely any phase of the question which more clearly demonstrates the value of these acts than the fact that the Department has been able to secure such general co-operation in its work.

The attention which has already been given to the cheese and vinegar acts of the session of 1897 clearly demonstrates the fact that important modifications are needed in both, and that these should be carefully considered and secured as soon as possible. Among the most important of these I may suggest the amendment of the cheese law so as to reduce the legal grades of cheese from five to two, or at most to but three, and the amendment of the vinegar law so that its provisions may be made more clear and readily understood by the dealers as well as by the special agents of the Department. Several of its provisions are contradictory and are capable of more than one construction, while the whole act is too cumbersome and lengthy for the best practical results.

VETERINARY DIVISION.

Under the care and supervision of Dr. Pearson, this division of the Department has made rapid advances during the past year, and, if legislative action is to be taken as the criterion of endorsement, it has been remarkably successful; its work is so intimately connected with that of the State Live Stock Sanitary Board that it is absolutely necessary to consider the two as one, and this is made all the more easy because, with the exception of the Governor, all of the members of the Board are officers of the Department, and all of the expenditures of the Board must be endorsed by the Secretary of Agriculture.

During the past year the work of this division has been mainly directed against tuberculosis and glanders; and in the former work about 16,000 animals have been examined with tuberculin and about 2,500 condemned as tuberculous and paid for, in accordance with the provisions of law. The fact that fifteen per cent. of those examined are found to be tuberculous must not, however, be taken as an indication of the possible amount of infection existing, for the herds re-

ported are only examined with tuberculin after their owner has satisfied the officers of the Board that he has good reason to suppose that the herd is infected; and it therefore follows that this proportion can only be accepted as referring to the suspected herds of the State.

The price paid for infected animals condemned and killed by orders of the Board has varied greatly, the maximum for animals of common stock being fixed by law at $25.00 each, and for registered ones at $50.00 each; the actual valuations have varied from these amounts down to less than ten dollars in some cases. The report of Dr. Pearson, in another portion of this volume, gives the more exact figures as to probable infection, condemnation and valuation.

During the session of the recent Legislature an act was passed giving the Board power over the motions of animals coming into our State, the theory being that it would be impossible to even partially free the State from tuberculosis so long as infected animals were liable to come in from other states, and so long as the fact that such animals were paid for by our State officers, might possibly constitute an incentive to bring them over our borders. This act gives the Board great powers which should be used with proper caution and discretion, and in such a manner as to inflict a minimum of loss and trouble upon the interests affected. The Board has adopted rules for governing the movements of animals coming into the State which it is believed will, while they give the least possible trouble to owners that is consistent with safety, at the same time give the maximum of protection to animals already in the State.

The act upon which these rules are founded gives the shipper the choice of three plans, either of which is carefully provided for by the rules of the Board, and either of which will be satisfactory to the Board as a means of protecting the interests of resident stock owners.

These provisions, which follow the lines laid down by the law, are practically as follows:

1. The officers of the Board will accept as sufficient evidence of freedom from contagious disease the certificates of proper officers in the states from which the animals are shipped, and the State will expect the same courtesy from the officers of other states to which animals may be shipped from our own State.

2. The animals may be detained at or near the point at which they enter our State and there tested with tuberculin by some one approved by the Board, and, proving free from disease, will be entitled to a permit which will allow their shipment to any portion of the State.

3. They may be shipped in quarantine to their ultimate destination in the State and there be submitted to a tuberculin test by a surgeon, approved by the Board, and his certificate of freedom from disease shall be deemed conclusive evidence that the animals can be safely mixed with stock already in the State.

Section second of the act (act of May 26, 1897) provides, that except in the first plan, the tuberculin tests shall be at the expense of the owner, and may be performed by any surgeon selected by the owner who is also satisfactory to the Board, but that the latter requirement is imperative in order to prevent tests by incompetent persons.

It is as yet too soon to judge of the effects of this law, but the experience of other states which have adopted its leading provisions make it evident that its effects must and will be beneficial, and will prevent the introduction of diseased animals into our State. Its effects are not applicable to animals intended for slaughter, and by the express provisions of the act itself are limited to "dairy cows and cattle for breeding purposes," and it therefore inflicts no hardship or inconvenience upon the trade in beef cattle.

Those who have given attention to the question of tuberculosis, as it exists in the human and animal races, have been strongly impressed with the theory that many of the cases are preventable, and with proper precaution and care, need not necessarily lead to the death or condemnation of the animal infected. But there was nothing practical to which the members of the Board could point as a proof of this belief and theory. It was believed by the members of the Board that a portion of the State funds carefully and economically invested in ascertaining the correctness or falsity of this theory would be a good investment, and accordingly the Legislature was asked for a specific appropriation to be applied to this purpose only; one of $15,000 for two years was promptly granted, and the Board has commenced a series of extensive experiments to show the comparative effects of the best and worst sanitary surroundings and their results in spreading the disease, and, although too early to give anything in the form of a conclusion, yet I may state that everything points to the belief that, when surrounded by the best sanitary conditions, the spread of tuberculosis through a herd, and possibly through an animal, may be prevented and that while, as in the past, animals of a certain conformation will prove more liable to the disease, yet we think it will be conclusively shown that much of its losses are preventable and that the sanitary surroundings have much to do with the percentage of loss.

By the use of its current funds under former appropriations the Board has conducted experiments with tuberculin and tuberculous animals which have proven to the entire satisfaction of Drs. Pearson and Ravenel that repeated injections, until the system fails to show reaction, will and does encyst the tubercles, and will in this manner check the disease to a very material degree. Cows infected with tuberculosis in one of its worst forms and from one of the worst infected herds in the State, were placed under favorable sanitary surroundings as to light, air and food and injected with tuberculin until their systems failed to react; one of these animals was killed and a

post mortem distinctly showed that the tuberculous deposits had been encased in a gristly material which, at least for the time being, prevented any danger from them, and that they appeared to exist in the animal merely as so many foreign bodies, and as harmless as a bullet or shot encysted in the same manner.

It has also been shown by the officers of the Board that an infected animal, after three or more carefully conducted injections, fails to react to the tuberculin test and the inference is that, except by reinfection, such animals are free from the danger of communicating the disease to others or from injury to themselves, but further and more extended experiments are needed, and will be made, before definite conclusions can be safely arrived at, but sufficient has already been shown to prove that if the work of the Board had been confined to these experminents alone, the results would have fully warranted every cent of expenditure which the State has thus far been called upon to make.

Acting upon the information given above, the Board has ordered the erection of a building which shall combine within its limits the best and worst sanitary surroundings, and animals have been placed in its various parts under conditions which will give sanitary surroundings, especially as to air and light, their full power and effect, and the results will be looked for with no little interest on the part of the members of the Board and others who have interested themselves in the experiment. If the results are as it is anticipated they will be, it will not only greatly economize the enforcement of existing laws, but will also serve as an object lesson to the dairymen of our State, many of whom are encouraging outbreaks of tuberculosis and other contagious diseases by violations of the laws of sanitation, and, if the experiments are successful, the Board may, instead of giving, as now, mere assertions as to the effects of sanitary surroundings, can point to demonstrated facts as a proof of their statements.

The Board also has, at the Veterinary Department of the Pennsylvania University, a laboratory under the care of Dr. Ravenel, in which tuberculin for tuberculosis and malein for glanders have been prepared and a large amount of expenditure saved to the State, and in addition, the Board and its officers have been furnished with an article upon which they could rely for results; an important consideration, because a slight defect in the agents used might not only render them abortive but even dangerous by giving a sense of safety which did not legitimately exist.

It is gratifying to report that the opposition which at first met the work of this Board has all vanished, and that instead of opposition there are now more applications for tuberculin tests than the funds at the disposal of the Board will admit, and that instead of making tests in all cases of applications, the Board is compelled, as an act of justice to the owners of infected herds, to demand some proof that the appli-

cant has good reason to suspect that his herd is infected, and when, as has been stated, even under these provisions, there are more applications for tuberculin examinations than the Board can attend to, it speaks volumes for the popularity of the work performed.

It is also a matter of congratulation that, notwithstanding the large number of animals examined and condemned, no mistake has yet been made, it being a rule of the Board that post mortems shall be held of condemned animals, so that there may be no room for doubt as to the correctness of the tuberculin tests, and the surgeons employed have in all cases positive orders to do everything in their power to demonstrate the correctness of the tuberculin tests as a means of diagnosing tuberculosis.

In addition to the work in connection with tuberculosis, Dr. Pearson has also devoted more or less time to hog cholera and to rabies and other contagious diseases, and in all cases in which any disease of this character has been reported, advice has been freely given, or, if the cases appeared to warrant it, an examination was made of the outbreak, and it is believed that much good has been done in this manner.

TOBACCO EXPERIMENTS.

Previous to the year 1895, the Pennsylvania State College Experiment Station had commenced a series of experiments for the purpose of ascertaining the results of different fertilizers upon the yield and quality of the tobacco crop, and had, up to the year named, carried them forward to a point at which their value and usefulness to the tobacco growers of our State was evident. An act making an appropriation to carry on the work during the term from June 1, 1895 to May 30, 1896, having failed to become a law, the Department of Agriculture, fully recognizing the value of the experiments as far as completed and believing that their result in the future would fully warrant the outlay, pledged itself to the officers of the Station for bills incurred in the carrying out of the experiment, provided the total amount of the bills did not exceed $1,000 per year for the two years named.

When, after the legislative session of 1897, the Legislature again failed to make provision for these experiments, the Department again pledged itself for the expenses for the two years ending May 30, 1899.

This action compelled the Department to economize in other directions, but it was then believed, and the results have confirmed that be

lief, that the value of the experiments to the tobacco growers of the State would be far above the cost to the Department, and none of the officers of the Department have thus far regretted the economy which they were thus compelled to exercise in certain directions, in order not only to continue the good work commenced by the Station, but also to save the work and expenditures which had been incurred when the Department assumed the expenses of the experiment, and our only regret has been that the amount appropriated to the general work of the Department was so limited, that the above amounts could not be safely exceeded without material loss in our work in other directions.

This series of experiments was originally commenced for the purpose of ascertaining the effect of different kinds of fertilizers upon not only the yield, but also the quality of the tobacco leaf, and they included outlays which no private grower could be expected to assume. Their primary object is thus outlined by Dr. Frear, Chemist of the Station and Department of Agriculture, who has charge of the work:

"The problems considered were prominently these:

1. What is the effect of phosphoric acid, in the soluble form, upon tobacco development?

2. Is carbonate of potash, in the form of a double carbonate of magnesia and potash, superior to sulphate of potash?

3. Which is the preferable form of nitrogen, fertilizers containing its nitrogen in an inorganic combination or one in which a portion of it is supplied in the more soluble and more quickly available forms, or nitrates or ammonium salts?

4. Among the sources of organic nitrogen, which is the better, those more quickly disposable in the soil, such as cotton seed meal and linseed meal, or a material probably more slowly decomposed, such as bone-dust? And then, in general, how does each of these combinations of commercial fertilizer materials compare with the ordinary application of horse manure?"

Tests of this nature with tobacco have elements of doubt involved which are not found in ordinary farm crops, and hence different problems are to be dealt with; it is one matter to produce a large weight of leaf and another to produce leaves of a first class quality, and it is well known to all tobacco growers and dealers that it is possible that a smaller crop of excellent quality may produce more profit per acre than a larger one of second class in quality, and hence, in outlining these experiments Dr. Frear included the following items:

1. The weight of the crop.
2. The proportion of the better sorts of leaves.
3. The proportion of leaf to stalk.
4. The proportion of the stripped leaf to the mid-rib and stem.
5. The thickness of the several portions of the leaf as shown by accurate measurements.

6. The size of the leaf shown in the same manner.

7. The burning quality of the leaf.

8. The quality of the cured leaf judged by the expert tobacco buyer.

9. The quality of the sweated leaf judged in the same way and from partial analyses.

10. The quality of the tobacco in the cigar adjudged by various experienced smokers.

In order to render the experiments of as general value as possible, these experiments were carried on in duplicate in some of the most prominent tobacco growing regions of the State, a careful analyses of soils and fertilizers made, and a series of very careful weather records kept; in fact, the experiments appear to have been guarded at every point and made as practical as possible under the circumstances, under which they were and are conducted.

A third factor in these experiments is thus outlined by Dr. Frear in his report to the Department:

"A third line of experiment has been undertaken to determine, more precisely than had heretofore been done, the exact conditions of temperature and humidity prevailing in Lancaster county curing barns so constructed that these conditions of temperature and humidity could be controlled, to ascertain whether it might not be readily possible to avoid the dangers that threaten the crop curing in the ordinary manner, and even to improve and make more uniform the character of the cured leaf. Experiments have been carried on for two seasons in the Snow barn, which is constructed so as to permit the control above indicated, and in addition to the work on curing, some preliminary experiments have been made upon the forced sweating of the tobacco leaf, also under controlling conditions of temperature and humidity."

The importance of these experiments is such that the Legislature should not trust to their being carried on by the Department of Agriculture from its limited appropriations, but the Station should have liberal legislative support, as State funds expended in this manner will be sure to give direct benefit to all who are engaged in this important branch of agricultural industry, and all encouragement is at this time particularly applicable, as it is believed and hoped that we are about entering upon an era of increased prosperity for this special industry.

SPECIAL INVESTIGATIONS.

Section sixth of the act of March 13, 1895, provides "That the Secretary may at his discretion, employ experts for special examinations or investigations."

Acting under the authority given by this section, I have employed suitable persons to make the following investigations and reports, the results of which have appeared or will appear either in this report or in the form of bulletins:

1. THE MILK SUPPLY OF CITIES; by M. E. McDonnell, of the State Experiment Station. The object of this investigation is to obtain a practical knowledge of the milk supply of our leading cities and towns, so that the Department may be in proper shape to give definite information to the committees of the Legislature under whose consideration and action proposed laws regulating the milk supplies will come; during the past sessions of the Legislature the committees of both branches of the Legislature have been confused by a mass of conflicting evidence, often of exactly a contrary nature, coming from men who are apparently entitled to consideration, and thus far the result has been that we have either secured no legislation at all or have added to our statute books that which has proven to be a disadvantage, rather than a benefit. It is believed that the report of Mr. McDonnell will present the matter in a practical and unbiased form, which will give those requiring it, information of value.

2. EFFECTS OF LIME UPON CROPS AND SOIL; by Dr. William Frear, Chemist of the Department and of the State Experiment Station. The discussions at our farmers' institutes and other agricultural meetings has fully proven that there is not only a wide difference of opinion among practical men as to the effects of lime, but also as to the manner in which it produces these effects. Dr. Frear was requested to give the matter a careful examination, make a long series of chemical analyses and gather from practical farmers all the evidence possible. The work is one which will require much time and careful examination, and no report is expected this year, and the examination will be extended into next year, and a final and conclusive report will be made as soon as practicable.

3. MOTIVE POWER; by J. A. Hunter, Pennsylvania State College. The fact that our farmers are using naptha engines, horse power, steam engines, wind and other powers under the same conditions and often under similar surroundings, has convinced many that the question of economical motive power is one which needs attention, and Mr. Hunter has been selected to give the question, in all of its bearings, a careful

examination and report, and it is believed that when he has concluded his work, we will have a mass of evidence which will throw much light on the subject.

4. GINSENG CULTURE; by Prof. George C. Butz, Pennsylvania State College. As our farmers as looking around for what may be termed "side crops" to add to the profits of the general agriculture, it seemed as if the fact that large amounts of ginseng are annually bought and shipped to China and other Asiatic ports, and that it grows wild in some of the counties of our State, and may be cultivated in all of them, it was believed that an investigation as to yield, profit and culture might be of benefit, and hence the selection of the subject and the appointment of Prof. Butz to investigate and report on it.

5. BUTTER SUPPLY; by Harry Hayward, State Experiment Station. In these days when oleo, "boiled butter, manipulated butter, cream ripeners" and other sources of a contaminated butter supply are so prevalent, it was thought that a careful investigation into the general subject of "butter supply" might result in good to our dairymen and consumers, and attention is called to the report of Mr. Hayward as the means of settling many of the disputed points in the topic which he has so ably investigated.

6. SEX IN PLANTS; by Josiah Hoopes, West Chester, Pa. The long connection of Mr. Hoopes with the growth of trees, plants and shrubs seemed to make him especially suitable for investigating and reporting upon this subject which, to the average farmer, has so many mysteries, nearly all of which disappear under the light of Mr. Hoopes' investigations.

7. BARK OF TREES; by Thomas Meehan, Germantown, Pa. This question is always one of interest, and leads the practical farmer to an investigation of the wonders of nature which are all around him, and, with similar knowledge he cannot but make his calling more pleasant and less monotonous.

8. FUNGOUS DISEASES OF TREES; by Prof. Byron D. Halsted, New Brunswick, New Jersey. The annual loss to trees by fungoid diseases and the want of a proper knowledge of these diseases and their character are sufficient excuse for the adoption of it for an investigation, such as is reported by Mr. Halsted elsewhere.

9. TOBACCO CULTURE; by F. R. Diffenderffer, Lancaster, Pa. The importance of this crop to the farmer in general and to the Lancaster county farmer in particular, and Mr. Diffenderffer's well known connection and close touch with the best and most practical growers of the State, are a sufficient guarantee that the subject assigned to him has received its proper share of care and attention.

10. THE ACTION OF PRESERVATIVES; by Dr. Henry Leffman, Philadelphia. This topic, in the interest of legislation in relation to the use of preservatives in milk and their effect as noted by the officers of the

Dairy and Food Division, as they find them in food products, makes the question one of great importance. Nothing has been done in the line of scientific research in this direction recently, and it is believed that the report of Dr. Leffman will settle many of the perplexing questions which have from time to time met the officers of the Department in carrying into effect the various food laws now upon our statute books.

11. Farm Titles and What They Include; by Hon. John P. Elkin, Indiana, Pa. Mr. Elkin's fitness for an investigation of this character is undoubted, and anything that he may furnish will be accepted as correct.

12. Legal Rights and Duties of Farm Employer and Farm Employe; by Hon. Geo. W. Hood, Indiana, Pa. The addresses on this and similar topics which Mr. Hood has from time to time delivered at meetings of the Board of Agriculture are a sufficient guarantee of his ability to handle his topic.

13. Cheese Examinations; by Drs. Frear, Aschman and Cochran. During the period which elapsed between the passage of the law regulating the manufacture and sale of cheese and its being put into force, various questions were raised against the law by dealers in cheese; these all depended upon practical and readily ascertainable facts, and a series of analyses were ordered in three series, each by a chemist working independently, and the results as obtained have not only proven of great use in our own State, but have also attracted more or less notice in all states in which similar laws are in effect. The result of the investigations was to satisfy the dealers in cheese that in the main, theory contentions were founded upon a basis which were not practical, and which would not bear the light of impartial investigations.

14. Poisons Developed in Food by Fermentation ; by Prof. F. T. Aschman, of the Department for the Western District of the State. This investigation will include the formation of poisonous matters in cheese, milk and other dairy products.

15. Coloring Matters in Food and Confections ; by Prof. C. B Cochran, West Chester, Pa. During the enforcement of the various acts relating to food and food products a prominent side question which often came up was that of the use and effects of coloring matters, and Prof. Cochran was directed to make a careful examination and report results; this work has required a large number of analyses and is expected to furnish the officers of the Department with reliable and practical information which may in the future guide their actions in the enforcement of laws which directly or indirectly relate to the use of injurious coloring matters.

16. Gardening for Market ; by R. M. Simmers, Phoenixville, Pa. The addresses of Mr. Simmers at our farmers' institutes have aroused a desire upon the part of our farmers who reside near large towns

and good markets for vegetables to know more as to their production, profits and yields, and to gratify and supply this clearly expressed want, Mr. Simmers was selected for the duty of examining and reporting upon the question. The fact that he has for many years been a practical market gardener eminently fitted him for the work and his report will fill a want, felt and expressed, in the agriculture of our State.

17. FARM PRICES; by Gilbert Cope, West Chester, Pa. During discussions of topics relating to the farming of the past and present, no subject came up with greater frequency than that of the comparative prices of the past and present, and Mr. Cope was accordingly appointed to collect data and make a report which should place upon record these items in such a manner as to hereafter settle the question beyond a doubt.

18. BUTTER-FAT, WATER AND CURD IN BUTTER; by Prof. F. A. Genth, Philadelphia, Pa. During the enforcement of the law relating to oleomargarine and imitation butter the officers of the Department were often met with questions, perhaps on the witness stand, which involved the relative proportions of butter-fat and water in butter; in the analyses made by our chemists the one item of water was found to vary greatly, and hence it was deemed important that we should have definite information which would enable us to judge when the elements of water and curd existed in sufficient amounts to constitute adulteration within the meaning of our law. The examination has involved a large number of analyses of samples of butter, and we consider the results as conclusive and entirely satisfactory. They are in a form in which they can be used during suits for the enforcement of any of the laws relating to dairy products.

19. PRACTICAL EXPERIENCE WITH FOREST RESTORATION AND IN CREATING A FOREST NURSERY; by F. R. Meier, Consulting Forester. The recent enactment of laws relating to forestry, forestry reservations and reforestration of cleared lands makes it important that those interested should have the best and most recent data upon which to work. The position of Mr. Meier ensures a practical and complete treatment of his topic which cannot fail to be of interest and value to the reader in search of information along the lines of the subject upon which he reports.

20. THE ECONOMIC RELATION OF THE MOLE TO AGRICULTURE; by Harry Wilson, Gum Tree, Pa. This investigation is upon new ground and contains much that will be new even to farmers who have observed some of the habits of the animal named.

21. FUNGI AFFECTING OUR FOREST TREES; by Prof. Byron D. Halsted, New Brunswick, New Jersey. The intimate knowledge which Prof. Halsted possesses in relation to all fungous growth is a sufficient guarantee for the character of his report upon this topic.

22. Relation of Forests to Water Power; by John Birkinbine, Philadelphia, Pa. If any apology was necessary for an investigation into this topic, it would be found in the condition of the failing water powers of our State, and its economy in the growing value of and demand for water powers for the generation of electricity. Mr. Birkinbine is an acknowledged authority upon this and similar questions.

23. The Pulp Industry as it Affects our Forests; by Dr. J. T. Rothrock, Forestry Commissioner of the State. It is an important topic and one which carries with it an interest which is intimately connected with reforestration and the preservation of our present forest areas.

24. Forest Fires and the Best Methods of Subduing Them; by George Boak. This embraces a question in which all farmers are indirectly interested and in which all owners of timber lands are directly interested, and the investigation treats of a branch of the forestry problem which is of great importance just now in consideration of the advanced station taken by our State Legislature in relation to forest fires and their prevention.

25. The Actual Losses Sustained by the State During the Past Year From Forest Fires; by Robert S. Conklin, Clerk of the Forestry Division of the Department of Agriculture. Mr. Conklin has given much time and attention to the topic, and collected a large amount of raliable data bearing directly upon the question of losses from this source, and some of his deductions, facts and figures will more or less surprise those who may have given the question but superficial attention.

26. The Danish Method of Controlling Tuberculosis in Cattle; by Prof. B. Bang, of the Veterinary Agricultural College of Denmark. The connection of Prof. Bang with the work of eradicating tuberculosis in Denmark gives him an immense fund of information upon branches of the work which are either comparatively unknown or but little understood in this country. The fact that the work of eradicating or controlling tuberculosis in Denmark has been in progress, much longer than any similar work in this country, gives Prof. Bangs' article a special interest and value.

27. Detection of Adulteration in Butter; by Prof. C. B. Cochran, West Chester, Pa. As chemist of the Dairy and Food Commissioner and of the Department, Prof. Cochran has analyzed and reported upon a large number of samples of butter, and this report is the result of his experience in the work.

RURAL FREE MAIL DELIVERY.

In my annual report of last year I used the following language, and the results and experience of another year would only lead me to make it even more emphatic:

"The discussions of our farmers' institutes and the correspondence of the Department both clearly prove that our farmers have asked for this appropriation for the purpose of testing the practicability of the plan, not because they doubted the fairness or justice of the request, but because they realized clearly that the question was one of comparative cost rather than expediency or justice.

"The argument has been advanced that it is out of the question to institute a general free delivery in the country districts, and this is granted. Our farmers have not asked for this nor do they believe that such a system is practicable, but if, after first being tried in the more thickly populated agricultural districts, its success or failure has been demonstrated, than it can be extended to doubtful districts, until it has been ascertained just how far and to what extent it may be carried without involving too much expense."

During the year ending June 30, 1897, this system has been practically tested in twenty-nine states and over forty-four delivery routes, and the First Assistant Postmaster General makes the following official report as to the results:

"The general results obtained have been so satisfactory as to suggest the feasibility of making rural delivery a permanent feature of postal administration in the United States, not immediately, nor in all directions at once, but in some gradual and graduated form, the character of which might be regulated by the tenor of the reports herewith presented as to the experimental service."

The first appropriation made for the test of this system was $10,000. During the year ending June 30, 1897, Congress appropriated $30,000, and for the coming year has given $50,000 for the purpose. The first service was commenced in West Virginia, October 1, 1896, and during the same year the experiment was extended to the states of Maryland, Missouri, New York, Ohio, Indiana, Virginia, Arkansas, North Carolina, Kansas and later in the year to fifteen other states, and during the past year the states of Minnesota, Kentucky, California and Tennessee. The system was first tested in Pennsylvania in November. 1896.

In Pennsylvania the system has been tested by two delivery routes. one in Lancaster county and the other in Westmoreland county. Of these tests the First Assistant Postmaster General reports as follows:

"Widely different conditions prevail in the two counties. The routes in Lancaster county run through a rich farming country, with an intelligent population, largely of German descent, and with good roads. In Westmoreland county, the conditions are hard. The rural population is scattered, the country very rough and the roads bad.

"The two routes started in Lancaster county begin at Lancaster city and include the territory embraced with the service of six minor post towns. Lancaster county is rich in post offices, there being nearly 150 fourth-class post offices within its limits, a large proportion of which, together with several star routes, might be dispensed with if free delivery in a permanent form were extended over the whole county. The area covered by the present routes is about 30 square miles, with from 16 to 20 miles of daily travel for each carrier. One route extends from Lancaster to Kready, Mountville, Windom and back to Lancaster; the other to Bausman, Millersville, Letort and back to Lancaster. The service was popular from the start and soon resulted in a large increase in the number of letters and newspapers carried.

"Two starting points were established in Westmoreland county, one at Ruffsdale, the other at New Stanton. The Ruffsdale carrier includes within his delivery the offices of Mendon, Walt's Mill and Hunkers. The New Stanton carrier's route takes in the offices of Cribbs, Target, Darrah and Madison. Within a short time after the establishment of the service the number of pieces of mail carried was doubled."

There are two points of importance established by this extract from the official report, neither of which were anticipated when the trial was first inaugurated. One is that the rural free mail delivery will displace a number of postmasters and postoffices, and the salaries thus saved should be credited to the expenses of the system. The second is that in both of the Pennsylvania counties the amount of mail matter received by farmers has either been largely increased or doubled in amount. Either of these effects should be credited to the system when its final balance sheet is made up, and both should have a fair amount of credit.

From the tabulated portion of the report above quoted from, I find the cost of the work to have been as follows, each postoffice limit being considered separately and as a distinct district: In the Lancaster county routes the average cost per piece of mail delivered, was eight-tenths of a cent; in the New Stanton (Westmoreland county) route, the cost averaged 2.04 cents; in the Ruffsdale (Westmoreland county) route, the cost per piece of mail matter delivered was 1.13 cents; and, considering the experiment in Pennsylvania as a whole, the average cost of delivering each piece of mail matter was 1.32 cents. This is without giving any credit to the probable displacement of fourth-class

postmasters and postoffices by the general substitution of the delivery system, nor does it credit the advantage which will naturally follow the rapid increase in the amount of mail matter delivered each year.

Considering the system of free rural delivery as a whole and including all the routes established by the 84 carriers in 44 states, the average cost for delivery per piece of mail has been 1.68 cents. The population thus served has numbered 22,772 and the number of pieces delivered 836,308 from October, 1896, to June 30, 1897. The average pay of the carriers has been $283.61 per year; the average area served by each carrier has been 20.93 miles; the average number of miles traveled by each carrier has been 22.

Of the manner in which this work has been accomplished, the Assistant Postmaster General writes as follows:

"According to the varying conditions of the country traversed the rural carriers perform their services on horseback, or riding in buckboards, buggies, two wheeled carts or on bicycles. In some states they have to cross farms and pull down bars and ride over some fields to deliver and collect their mails. In no instance has any serious complaint been made of this invasion of private rights. On the contrary the co-operation of the communities served has in every instance been cheerfully and effectively given. The farmers, at their own cost, have put up boxes at cross roads and at all other convenient places for the reception of the mails."

The official report suggests that farmers may, of their own volition, materially assist the system by combining the collection of mail matter by the same carrier who delivers it, and gives the following as an instance of what has already been done in this direction: "This plan has actually been put into operation by the citizens of one district of Massachusetts, on their own responsibility, they paying the mail messenger $2.00 per annum for each family thus accommodated by him."

The Assistant Postmaster General thus alludes to two of the hindrances which have been noted in the experimental delivery system:

"There has been, and naturally so in some localities, a hesitation on the part of the community to break in upon their long-established custom of riding to town for their mails when they have no assurance as to how long free delivery is to last. Then again, postmasters of the fourth class, who are paid according to the amount of mail matter cancelled in their offices, do not find it to their interest to encourage their patrons to transfer their mail delivery to the neighboring free delivery route. It is asking too much of human nature to expect them to divert from themselves a part of their income purely for the betterment of the service. That so much has been accomplished in spite of these retarding influences indicates much greater possibilities for the future."

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The report from which I have quoted contains numerous items of history which are interesting to the student after information relative to the increase of our postal system; referring to the olden time manner of performing the work, he writes:

"Less than four years ago the aged postmaster of an Ohio town, then still holding the office, at the end of sixty-four years of continuous service, was able to recall the time when the charge for one letter to be transmitted 400 miles or more was 25 cents, and in commutation of this service he had at different times received, as a just equivalent for the postage, either two bushels of oats, five dozen eggs, four pounds of butter, three bushels of wheat or one and one-fourth pounds of common wool."

A general summary of the report of the Assistant Postmaster General leads one to the conclusion that the results of free mail delivery thus far have been such as clearly indicate that, with a proper appropriation from Congress, it will become a permanent arrangement for all thickly populated rural districts, and that it is capable of a greater extension than is at present thought to be either possible or practicable.

THE INTER-STATE COMMERCE ACT.

All of the acts which have been assigned to the Department for enforcement partake more of the nature of police regulations than of ordinary trade laws. The Pure Food Law of 1895 is clearly of this character; the vinegar law of 1897 and the cheese law of the same year, are also of the same character, and an examination of the principles which underlie them will convince any one that their enforcement is but the legal exercise of the police powers of the State.

This difference in the character of the two classes of laws is not properly understood, and is thus explained by Judge Williams, in his opinion in the case of the Commonwealth vs. George Schollenberger:

"His business is intra-state and not inter-state. Our act of 1885, under which this case arises, is not a trade regulation. It is a police law. This court has so repeatedly held, and our view of it was expressedly confirmed by the Supreme Court of the United States in Powell vs. the Commonwealth of Pennsylvania (127 U. S., 678), a case which turned upon that single question. It does not undertake to deal with the importer from any other country or state, but with the manufacturers and dealers within the State. It prohibits the manufacture and sale of oleomargarine within the limits of the State. It

also prohibits the sale, the offer to sell and having in possession with intent to sell the same as an article of food. It lays its prohibition on those who are fairly subject to its jurisdiction and no others. We have then, a valid police law, so declared by the highest tribunal of the land, which prohibits the sale of oleomargarine as an article of food within the State."

In the enforcement of all laws above alluded to, the Department has met the question of the effect of inter-state commerce laws upon sales of the prohibited article or with sales contrary to the provisions of the act, and in all cases our legal advisers have taken the position that the inter-state commerce acts protect articles of commerce in transit from one state to another until they are offered for sale in the state in which their sale is in violation of law, and that this protection then ceases, and they become a portion of the general commodities of the state and subject to all of the restrictions which would have, under similar circumstances, governed the offer and sale of similar articles manufactured in the State.

Taking this view of the case, the Department held that the inter-state commerce law would protect cheese shipped into our State from New York and Ohio until it was offered for sale in our State, and that the protection there ceased, and our agents have been instructed to apply the provisions of the act of 1897 just as they would have done had the cheese been manufactured in Pennsylvania.

The claim has been made that a box of cheese was an "original" package, and that, as such, it can be sold and re-sold until the package is opened and the cheese divided, but this view of the case has not been accepted by our legal advisers, and in all cases the provisions of the law have been enforced fully and in precisely the same manner as if the cheese or other commodity had been made in our State.

In referring to the effect of the inter-state commerce law as it relates to the police regulations of the State, Judge Williams (Commonwealth vs. George Schollenberger) thus decides:

"If the residence of the dealer could affect the character of his trade, then our police laws, intended to protect our own people, would operate as a discrimination against our own citizens and in favor of the citizens of other states, and would commit to those having no interests in common with us, a most odious monopoly in every kind or form of traffic which our State should attempt to regulate or suppress.

Intrenched behind the inter-state commerce clause so construed, citizens of other states could prey upon our people, trample upon our laws and make gain out of a traffic forbidden to our citizens, only to be delivered up absolutely and unconditionally to them. It would require only that the citizens of another state should establish a store in some of our towns or cities, or in all of them, and conduct a local business to meet the local demand, and when called upon by the officers

of the law, make reply that he made the goods in some other state, and, as a manufacturer, supplied himself as a local dealer with wares of a foreign state.

In the case of Commonwealth vs. George Schollenberger, it was charged and admitted that the defendant sold a ten pound package of oleomargarine to a boarding house keeper and that the package had not been opened or broken; the defense claimed that it was, therefore, an original package and not subject to State laws. In his opinion on the case, Judge Williams used the following language:

"If a pint bottle of whiskey is an original package under the protection of Congress, and can be sold as such regardless of the police legislation of the State, we cannot punish the sale to a minor, to a person of known intemperate habits, to a lunatic, on election days or on the Sabbath. All power over the traffic for police purposes is gone, and why? Because the power to regulate inter-state commerce, intended to guard against stoppage along state lines, has been extended by construction until it is made to reach and protect retail traffic carried on within any state, if the things sold have come into the retailer's store from a non-resident manufacturer or shipper. If this be sound construction, then the power of a state to restrict or prohibit an injurious traffic does not depend upon the deleterious character of the thing sold, or the manner in which sales are made, or the public or private injury inflicted by the sale, but on the manner in which the thing sold came into the possesion of the seller."

In view of these and other constructions which have been placed upon similar laws, the Department has held that, while it could not compel a manufacturer of cheese in New York or Ohio to comply with our State law in relation to branding, yet it could with justice compel the dealer in Pennsylvania to see to it that the cheese is properly branded before it is offered for sale or sold, and in doing this it will always be found that the Department has, where the selection was possible, taken that course which would inflict the minimum of hardship upon the manufacturer and dealer alike, and that in every case the most liberal construction of the law possible has been taken advantage of in order to cause the least inconvenience to those interested and at the same time carry out the primary object of the act in protecting the purchaser and consumer.

In the recent case of the Armour Packing Company against the Dairy Commissioner of the State of Minnesota, in which the main contention was that the state law requiring that oleomargarine should be colored pink was unconstitutional, Judge Lochren of the United States Court for the Minnesota district, charged as follows:

"The state has undoubtedly the power of inspection and of confiscation in respect to articles of food put upon the market which are deleterious and unwholesome. And I think it may go further in re-

spect to articles of food and take effective measures to prevent the people from being deceived and imposed upon; not only by requiring the packages containing an imitation article of food to be so marked as to disclose its character, but may also require that the article itself, shall, in a designated way, be also marked for the same purpose."

In this case the Armour Packing Company, had in violation of law, sold oleomargarine either not colored at all or colored yellow in imitation of butter, and, during the hearing the question of inter-state commerce regulations having come up, Judge Lochren used the following explicit and unmistakable language:

"It is not invalid as interfering with the exclusive power of Congress to regulate commerce among the several states. The act does not interfere with oleomargarine as long as it remains an article of commerce and is being handled or stored as such. It is only after it has ceased to be an article of commerce and become a part of the property of the state, and as such is being sold or kept and exposed for sale that it comes under the act, which makes no distinction in favor of the article manufactured in this state or against that which is brought from other states.

"The serious question in respect to this act is whether it is a valid exercise of the police power of the state to require that all imitations of butter intended to be substitutes for that article shall be colored bright pink. It is certain, and not denied, that butterine or oleomargarine is a substitute for butter and so intended. It is equally certain that it is made in imitation of butter, even in color, so that it cannot, upon ordinary inspection and use, be distinguished from it, and that it is calculated and intended to deceive, not the purchasers in original packages, but the purchasers of small amounts at retail, and the consumers, into the belief that the article is in fact butter, is clear beyond doubt."

The decision of the Minnesota court, while it will have its effect in establishing the validity of laws requiring that oleomargarine shall be made of some distinguishing color, also conveys a valuable lesson to the Dairy and Food Commissioners of the various states. In this case the Dairy Commissioner seized and confiscated the oleomargarine which was involved in the suit without any procedure through the medium of a court, and the suit was brought by the Armour Packing Company to recover damages for the seizure. The court gave judgment against the Dairy Commissioner and in favor of the Armour Packing Company in the amount of $2,182.00 and the costs of suit, solely because the mode of procedure in the condemnation and confiscation had not been regular and through the medium of the proper court. The judge held that while the state had an undoubted right under the law to seize and confiscate the goods under consideration, this act could only be accomplished in a legal manner, and that a summary confiscation was not legal and would not be allowed.

ANALYSES OF COMMERCIAL FERTILIZERS.

The act of June 28, 1879 (section four) provides that "it shall be the duty of the Board of Agriculture to analyze such specimens of commercial fertilizers as may be furnished by its agents, such samples to be accompanied with proper proof, under oath or affirmation, that they were fairly drawn," and the act of March 13, 1895, transfers this duty to the Secretary of the Department of Agriculture.

As Secretary of the State Board of Agriculture, and more recently as Secretary of Agriculture, I have given my personal attention to the enforcement of the provisions of this act, and have at all times supervised the selection of samples, the analyses and the reporting of all analyses to manufacturers and others interested. The analyses are made by Dr. Frear, of the State Experiment Station, and are paid for under the provisions of section fifth of the act of June 28, 1879.

During the past year the special agents of the Department have sent in 1,514 samples, selected in all portions of the State and under all possible conditions, from the warehouse at the railroad station, from the grain drill of the farmer, from his barn and, in fact, from all possible localities and positions. They have been selected by men not in any way interested and under oath or affirmation, as required by law. I am fully satisfied that they fairly represent the fertilizers which are being sold to consumers in our State. Of these samples 1,482 have been officially tested and reported upon and copies of the analyses sent to the manufacturers and published and distributed in bulletin form for the benefit of the consumer.

As has been the case heretofore, the year is necessarily divided into two distinct portions, which embrace the fertilizers intended for the spring and fall trade. Many manufacturers send out brands for the spring trade which differ in name and composition from those intended for application to wheat and other autumn crops, and from five to seven special agents have been employed in the selection of samples.

Following this division of the year, I find that during the Spring portion, commencing April 1st, and ending May 15th, 550 samples were selected and are found with selling prices attached, in the following table:

Kind of Fertilizer.	Number of Brands.	Average Selling Price.
Complete fertilizers,	383	$24 02
Dissolved South Carolina Rock,	73	12 52
Ground bone,	57	27 44
Alkaline fertilizers,	26	15 66
Dissolved animal bone,	4	23 50
Muriate of potash,	2	40 38
Nitrate of soda,	2	46 63
Kainit,	2	12 88
Ammonite,	1	35 75
	550	

During the fall or second portion of the season, the selections amounted to 964 samples divided as follows:

Kind of Fertilizer.	Number of Samples.	Average Selling Price.
Complete fertilizers,	572	$23 03
Dissolved South Carolina rock,	174	12 32
Ground bone,	102	27 11
Alkaline fertilizers,	68	15 68
Dissolved animal bone,	23	23 78
Muriate of potash,	4	34 44
Kainit,	2	12 12
Bone black,	2	22 50
Ammonite,	1	35 75
	948	

By combining the two seasons and considering the year as a whole, we have the classified results as follows:

Kind of Fertilizer.	Number of Brands.	Average Selling Price.
Complete fertilizers,	955	$23 54
Dissolved South Carolina rock,	247	12 43
Ground bone,	159	27 29
Alkaline fertilizers,	94	15 62
Dissolved animal bone,	27	23 64
Muriate of potash,	6	37 41
Kainit,	4	12 50
Bone black,	2	22 50
Ammonite,	2	35 75
Nitrate of soda,	2	46 63
	1,498	

During the year 1897 licenses were granted for 967 distinct brands of fertilizers, all of which were offered for sale in our State. As compared with 1896, the work of recording and licensing fertilizers shows the following totals:

Kind of Fertilizer.	1896.	1897.
Complete fertilizers,	627	619
Dissolved South Carolina rock,	126	121
Ground bone,	109	113
Alkaline fertilizers,	69	87
Dissolved animal bone,	23	27
	954	967

With the number of agents, all working independently, there is, of course, more or less duplication of samples, especially of the leading brands; these samples, however, usually come from different portions of the State. In order to obtain a fair average test of the fertilizer as represented by the whole of these samples, Dr. Frear was requested to make "composite" samples by mixing all of the same brand and obtaining the composite sample from the mixture. This rule was applied to all samples of which there were two or more and in this manner 173 composite samples were obtained and tested. In making these, 465 distinct samples were used, the greatest number of any one brand being six.

There is probably no one of the numerous duties assigned to the Department of Agriculture which yields to the farmers of our State such immediate results at so little cost to them. It is estimated that we annually expend not less than $3,750,000 for fertilizers controlled by this law, and it is estimated that its results give our farmers a saving of ten per cent., or $375,000 per year. Inasmuch as the whole cost of the work is paid by license fees from manufacturers, the law is practically self-enforcing and causes no expenses to the taxpayers of the State.

FERTILIZER SUPPLIES.

When the act of June 28, 1879 (to regulate the manufacture and sale of fertilizers) became a law, farmers had not commenced to mix their own fertilizers but in anticipation of the fact that such a time would probably arrive, the law was so drafted that it would cover the case.

Section first of the act provides: "That every package of commercial fertilizer sold, offered or exposed for sale for manurial purposes within this Commonwealth, shall have plainly stamped thereon the name of the manufacturer, the place of manufacture, and an analysis stating the percentage therein contained of nitrogen, or its equivalent in ammonia, in an available form, of potash soluble in water, of soluble and reverted phosphoric acid, and of insoluble phosphoric acid: Provided, That any commercial fertilizer sold, offered or exposed for sale which shall contain none of the above named constituents shall be exempt from the provisions of this act."

Section sixth provides that: "The term 'commercial fertilizer' as used in this act, shall be taken to mean any and every substance imported, manufactured, prepared, or sold for fertilizing purposes, except barnyard manure, marl, lime, and wood ashes, and not exempt by the provisions of section one of this act."

During the past year there has been a considerable increase in the use of home-mixed fertilizers and large amounts of nitrate of soda, sulphate of ammonia, sulphate of potash and similar single ingredient materials have been purchased by our farmers for the purpose of compounding their own fertilizers.

The trade has increased to such an extent that it would seem that this class of purchasers were entitled to as much and the same protection as those who purchase their fertilizers ready mixed. They are quite as liable to imposition in the composition of each ingredient as the other class are in the mixed goods, and it has been the desire of the Department to extend to them all possible and legal protection.

These "fertilizer supplies" are composed of one or more of the following ingredients as named in the act alluded to: Nitrogen or ammonia in an available form, of potash soluble in water, and of soluble and reverted phosphoric acid and of insoluble phosphoric acid," and are clearly within the limits of the first section of the law and are certainly not exempt under the sixth section, and the Department therefore held that they should be licensed and recorded according to law, and that they should be branded or marked in accordance with the provisions of its first section, as quoted above, but in order that there might be no mistake about it, the opinion of the attorney General was asked.

In reply to my statement of the question, the Deputy Attorney General gave the following opinion:

Harrisburg, Pa., August 10, 1897.

Hon. Thomas J. Edge, Secretary of Agriculture, Harrisburg, Pa.:

Dear Sir: This Department is in receipt of your communication of recent date asking for instructions upon the question whether certain chemical compounds sold for fertilizing purposes should be branded

as required by the acts of 1879 and 1895. It seems very clear to me that the two acts above mentioned are intended to require such a marking of the packages or bags in which fertilizers are sold as will ensure protection to the purchaser thereof. Whether the fertilizers are mixed and sold by regular manufacturers, or are purchased in their chemical constituents and mixed afterwards, I think is not material so far as the proper marking of the packages or bags is concerned. It is the intention of the law to give proper notice to the purchaser of fertilizers of the constituents therein contained, and this can only be accomplished by requiring that all packages or bags containing fertilizers should be properly marked. It is my opinion that the Department is entirely right in its view of this question.

Very respectfully yours,

(Signed.) JNO. P. ELKIN,
Deputy Attorney General.

Manufacturers of mixed fertilizers have, with some reason on their side, claimed that it was unjust that they should be compelled to license their mixed fertilizers and that those selling fertilizer supplies should be allowed to sell their goods on the old plan without a guarantee as to their composition or purity, and instanced the fact, already known to the Department, that, fertilizer supplies, known under exactly the same trade name, but varying considerably as to their value, were upon the market and were being purchased by farmers for the purpose of compounding their own fertilizers.

After a correspondence with some of the leading manufacturers of commercial fertilizers, not only in this State but also at the fertilizer centres of the county, it was found that dealers in such supplies outside the State claimed that the inter-state commerce law protected their sales in Pennsylvania, and that the "original package decision" protected their sale after arrival in the State and until they reached the consumer.

In arriving at such a conclusion the dealers have probably failed to note the difference in the action between the ordinary trade regulations of a state and its police regulations; the act which regulates the manufacture and sale of fertilizers is a police and not a trade regulation, and it is claimed that, while it will not affect sales made from points outside the State to dealers or consumers in the State, it will not protect any sale made in the State, and that its protection ceases with the first offer to sell or sale made in the State.

This reasoning applies with equal force to goods brought into the State from foreign countries or imported goods; as soon as they cross the State boundary and are offered for sale in the State, they are subject and are regulated by the police laws of the State, and that while sales can be made, from points outside of the State direct to the con-

sumer, they cannot be legally made within the State lines until the provisions of the act for their regulation are complied with.

In the case of imported fertilizer supplies, it is found that each particular kind is usually controlled by one firm or company and hence one license taken out by that firm or company will cover all unless made by the firm, either direct or through other dealers in the State, and hence the trouble and expense of a compliance with the provisions of the law will be reduced to a minimum.

Believing that the position taken by the Department is in strict accordance with the requirements of the law and in the line of protection to the consumer, the Department will hereafter notify dealers, to whom notices are annually sent, of the decision of the Deputy Attorney General and of the claims of the Department, and it is believed that a general compliance will be found to follow.

SAN JOSE SCALE.

It is one of the wise provisions of nature that all of our insect pests except perhaps in a few of our most recent importations, are held in check by insect and fungoid enemies, and it is seldom that this balance of power is destroyed; occasionally from some cause not yet well explained, the pest, possibly through the absence of its enemy, obtains the mastery and the maximum of loss is again experienced, but this seldom is found to take place two years in succession, and the year following such an outbreak is usually signalized by the unusual absence of the pest and the corresponding abundance of the crop thus affected.

When the Hessian fly was imported at Trenton and first became known in the wheat fields of surrounding New Jersey, it was stated that farmers in this country would be compelled to abandon the cultivation of wheat; the fact was forgotten that in Europe, where they had known the fly for many years, good crops were still annually harvested in spite of its attacks. In a short time our farmers found from experience and observation that late seeding was the proper remedy, and since this has been generally adopted the loss has been reduced to a minimum.

When the potato patches of our western settlers joined those of the wild potatoes of Colorado the "Colorado potato beetle" at once improved the opportunity and rapidly passed eastwards, and we had a repetition of the experience of our New Jersey farmers with the Hessian fly of revolutionary times. For a time it appeared that we would be compelled to abandon the cultivation of the potato, but soon one

enemy, and soon after another, overtook and attacked the potato bug; first they were found dead in the patches with a greater or less abundance of fungoid growth in and around their bodies, and a short time after, were found killed in large numbers by an exceedingly minute louse or parasite. About this time or earlier, it was found that applications of Paris green, in mechanical solution, would prevent the ravages of the beetle and it was at once resorted to by our more progressive farmers, and soon by nearly all who attempted to cultivate the crop. Since then the injury committed has been reduced to its minimum and one of our largest potato growers stated, at one of our farmers' institutes, that the beetle had been a blessing to him and had been the means of his making a large amount of money upon the potato crop; his neighbors did not fight the beetle and he did, and thus had an open market for his crop.

So firmly was I impressed with this condition of affairs that, in my report of last year I used the following language:

"All of our fruit and farm crops are subject to injuries resulting from the introduction of insect pests and fungoid diseases, but their history, thus far, without exception, has been that for a few years they inflict a maximum amount of injury, but that after a short term, their natural enemies overtake them and the injury is reduced to a minimum, which is only interfered with when, from some unexplained cause, these natural enemies are present in smaller numbers, and thus fail to hold the original insect in check. The maximum of injury seldom occurs two years in succession and the succeeding season is marked by a limited number of insects."

During the recent meeting of the Society of Economic Zoologists, at Detroit, Prof. P. H. Rolfs, of the Florida Experiment Station, called the attention of the society to the fungoid enemies of the San Jose scale, and gave a full and interesting account of his propogation of the fungous growth and the subsequent rapid destruction of the scale by its dessemination.

Prof. Rolfs informed the convention that his attention had been called to the fact that the scale was, at least in spots, disappearing from the orchard of Dr. Funiak; several reasons were assigned to account for this destruction of the scale; some contended that it was due to the hard freeze of two or three years previous; the unusual condition of the weather was also suggested as a cause with which to account for the effect; others claimed that the death of the insects might be attributed to a severe drought which prevailed in that portion of Florida at that time.

After that careful examination which always goes with the training received by those who are employed at our Experiment Stations Prof. Rolfs was convinced that the peculiar condition of these somewhat isolated spots was due to some natural enemy which had destroyed the scale so far as its effects extended.

Reasoning from the usual character of fungoid diseases, Prof. Rolfs removed branches with the diseased scale insects, to orchards in which the scale was not yet diseased, and tied them close to and parallel with the limbs most thickly inhabited by the scale; of the result Dr. Rolfs writes as follows: "The orange colored prominences could be detected on many scales within twenty inches of the infested stick, and the stick had not (after the lapse of six weeks) lost its virtue."

Dr. Rolfs next step was to devise some means by which this fungoid enemy could be rapidly and cheaply propogated in cultures and thus prepared for dissemination to any point at which the San Jose scale existed. Bread which had been purposely prepared and soured was selected as the material in which to produce and increase the spores of the fungus, and the results were all that had been expected. Several other mediums were tried; the usual one of gelatin was tested, but given up for the acid bread; potatoes were also given a trial, but nothing gave as satisfactory results as the bread.

After the propogation of the spores had been brought to a point of success which warranted further steps, a series of experiments were instituted in which plum, peach and other infected trees were "inoculated" by the spores on the bread preparation.

Dr. Rolfs thus reports the results of these tests:

1. That so many of the experiments turned out favorably, substantiates the former expectation that the material might be grown artificially.

2. The material can be produced in great quantities, and its applica tions to insects is as easily accomplished as a single spraying with an insecticide.

3. It is more thorough than insecticides.

4. While it is nature's own remedy for striking a balance in Florida, it will doubtless be less effective in other localities and in dryer climates.

5. The orchardist who may not be a scientist can apply it properly.

6. The fungus is widely disseminated on a native scale, insuring a constant source of new material.

7. The fungus multiplies many fold more rapidly than the San Jose scale.

8. The rain washes the fungus and dead scale from the trees, leaving no sign of the tree having been diseased, except where the scale have done injury.

Dr. Rolfs states that the spores of these fungi, especially in a damp and moist time, multiply with wonderful rapidity, and if they once obtain lodgment will keep in advance of the San Jose scale and sooner or later either destroy or hold it completely in check. Under but moderately favorable conditions the spores begin to increase with great

rapidity in six weeks after the inoculation, but under more favorable surroundings, the effect is shown in much less time.

The spores of this fungus, as is the case with most of its class, passes through various stages of growth, in none of which it is capable of withstanding any reasonable amount of drought; in another it seems to be able to bear without injury very low temperatures, and that, during certain seasons its multiplication, naturally is not confined to insects as a media but is carried on through surrounding objects of its own selection.

In summarizing the results of his experiments and of his experience with fungus growth, generally, Dr. Rolfs, writes thus:

1. It has been definitely established that insects are subject to disease.

2. Diseases of insects have been, and are being employed to destroy insect pests.

3. Some diseases of insect pests may be disseminated artificially with profit.

4. This disease of the San Jose scale is present on at least three continents and in many countries. In several instances it is recorded as an important factor in controlling scale insects.

5. It is doubtless a native of Florida, as it occurs on native scale, in our hammocks.

6. This fungus may be transferred to trees infected with San Jose scale and a disease produced among the scales.

7. Large quantities of material may be produced in the laboratory in a short time and at a slight expense.

8. The laboratory grown material may be applied successfully by fruit growers.

9. This fungus cleared orchards more effectively of San Jose scale than could have been done by many sprayings.

10. It is now being tested north and south.

There appears to be a wide difference of opinion among practical entomologists as to the possibility of preventing the ravages of the San Jose scale; Prof. J. B. Smith, of the New Jersey Experiment Station, writes: "It has been charged, and not without some show of reason, that entomologists and some others are losing their heads in the matter of dealing with this insect (San Jose scale), and that there is an unnecessary and somewhat hysterical excitement created by an overabundance of lurid talk accompanied by an absence of careful study and work. The charge is not without some show of reason, for, after all, what basis is there for all the fuss that has been made? It is about time that the subject was considered carefully and without excitement, lest the reaction, when it comes as it inevitably must, destroy confidence in the warnings of the entomologist altogether."

Mr. Smith also states that the San Jose scale is not any more diffi

cult to kill than some of our native scales, and that "on some trees infested by both San Jose and "scurfy" scales winter treatment killed nearly all the pernicious form (San Jose), while the trees are now coated with the common species which the application left unharmed."

Prof. Smith gives the following mode of treatment with which he has had practical experience:

"After January 1, and at any time before the trees become in the least active, spray with pure kerosene of the ordinary 150 degree test. Be thorough, but not wasteful; use enough to make a film of kerosene capable of penetrating into the smallest crevice; but let that film be of the thinnest posible description. Do the work on a dry, bright day with enough air stirring to favor rapid evaporation and do it yourself, or at least superintend, so that carelessness in the application be not charged against the insecticide as inefficiency."

Prof. Smith states that on smooth barked trees whale oil soap, at the rate of two pounds to one gallon of water will do almost as well, but that it will not answer on rough bark trees.

Of this treatment with kerosene Dr. Webster of Ohio writes: "The San Jose scale is not spreading in Ohio so far as I know, but is being exterminated wherever its introduction has become known. In two orchards near New Richmond, Ohio, kerosene in an undiluted form has been used with marked success, both last year and this, without the least injury to the trees, either apple or peach. I am unwilling to recommend this treatment for general use as yet, but the results gained as against the San Jose scale are so valuable that I give the details with the hope that equally good results may be obtained elsewhere during other years."

In writing to a correspondent who has used the kerosene, Dr. Webster received a reply from which the following is an extract:

"The kerosene (clear coal oil such as we use in our lamps) which we used, was applied principally in the month of February when the ground was frozen. We applied it with a small varnish brush to some small trees, to the entire tree and on others only to the limbs that were most affected. My brother used a barrel sprayer, applying forty gallons of pure coal oil on 500 apple trees and fifteen peach trees. A part of the orchard he sprayed a second time."

The informant further adds that the trees, to which an application was made two years ago, are in excellent condition, have made fine growth and are as smooth as if varnished.

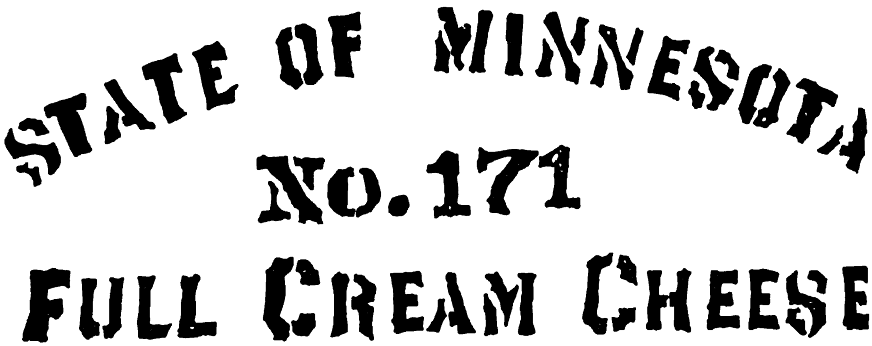
BRANDING CHEESE.

The act of June 23, 1897, which went into effect August 23, provides, by its second section, as follows:

"All cheese manufactured or sold within this Commonwealth shall be divided into five grades, and shall be branded or stenciled, in ordinary bold faced letters, not less than one inch in height, on two sides of each cheese, and upon the top and bottom of the box or case containing the cheese, the manufacturer's name and postoffice address and the words "Full Cream," "Three-fourths Cream," "One-half Cream," "One-fourth Cream," and "Skimmed Cheese." All cheese branded "Full Cream" shall contain not less than thirty-two per centum of butter-fat as may appear by proper test. All cheese branded "Three-fourths Cream" shall contain not less than twenty-four per centum of butter-fat as may appear upon proper test. All cheese branded "One-half Cream" shall contain not less than sixteen per centum of butter-fat as may appear upon proper test. All cheese branded "One-fourth Cream" shall contain not less than eight per centum of butter-fat as may appear upon proper test. And all cheese containing less than eight per centum of butter-fat, as may appear upon proper test, shall be branded "Skimmed Cheese."

The provisions of this section place unnecessary work upon the manufacturers of and dealers in cheese, and its provisions are not made sufficiently clear. During the time the law has been in effect the Department has had more or less trouble in getting the manufacturers and agents to brand their cheese so that it is not removed by the retail dealer before the cheese is cut. Many of both classes claim that the only sides of the cheese were the circular edges and therefore they place their brand directly upon the band which surrounds the cheese; this was removed by retail dealers before the cheese was cut and hence more or less trouble occurred between the agents of the Department and the dealers in reference to the questions as to whether the cheese had been properly branded or not. It was claimed by the officers of the Department that the top and bottom were just as much "sides of the cheese" as were the circular portion, and hence all dealers were requested to notify manufacturers to brand their cheese near the centre, on the top and bottom, and thus allow the retail dealer to have a portion of the brand upon the last piece left in his hands.

This section also places unnecessary labor and trouble on both manufacturer and dealer by making too many grades of cheese; the laws of nearly or quite all other states require but two grades, and



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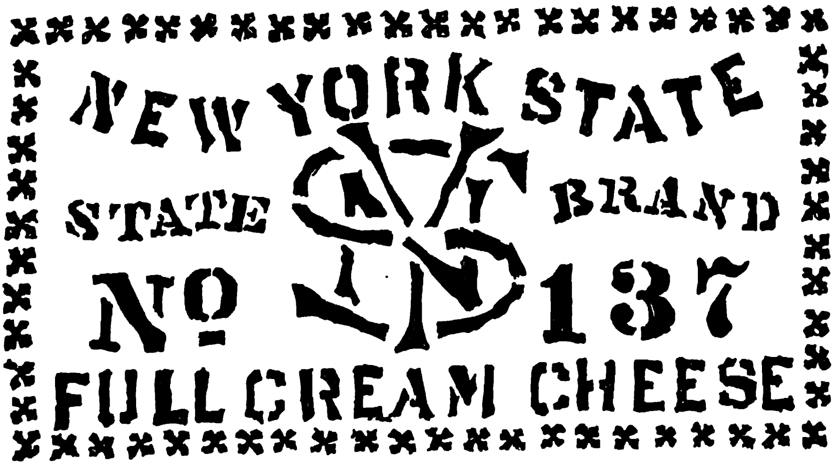

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MINNESOTA AND NEW YORK CHEESE BRANDS.

anything which does not come up to the standard of "Full Cream" is classed as a "Skimmed Cheese," the dividing point between the two being thirty-two per cent. of butter-fat.

The effect of this provision is to reduce the number of grades.

The adjoining States of New York and Ohio, from which our dealers obtain the bulk of the cheese sold in the State, have excellent laws governing its manufacture and sale, and their provisions are such as to remove a large proportion of the unnecessary hardship and labor entailed upon dealers by our law. The laws of the two states make but two grades and establish thirty-two per cent. of butter-fat as the line which divides them; any cheese guaranteed up to thirty-two per cent. of butter-fat is considered a "Full Cream Cheese" and anything that is not and cannot be guaranteed to this limit is a "Skimmed Milk Cheese," and the purchaser buys it at his own risk, for a skimmed milk cheese only.

The law of New York (section 33) provides that "Every manufacturer of "full milk cheese" may put a brand upon each cheese indicating "full milk cheese," and the date of the month and year when made, and no person shall use such a brand upon any cheese made from milk from which any of the cream has been taken. The Commissioner of Agriculture shall procure and issue to the cheese manufacturers of the State, on proper application therefor, and under such regulations as to the custody and use thereof as he may prescribe, a uniform stencil brand bearing a suitable device or motto and the words "New York State Full Cream Cheese." Every such brand shall be used upon the outside of the cheese and upon the package containing the same, and shall bear a different number for each separate factory."

In the application of this law the Commissioner of Agriculture provides uniform brands on which the number is left blank, and when an application is entered the appropriate number is cut on the brand and one sent to the manufacturer who makes the application.

Under this system any cheese may be traced by its factory number and the objections so vigorously urged by wholesale dealers that our State brand "gives their business away" is removed and the consumer equally as well secured in his rights.

The question of the right of our State to require that a manufacturer of cheese in Ohio or New York shall put his name and address on his cheese has been raised under the inter-state commerce law, but it has been definitely decided that the effects of the inter-state commerce law only protect the cheese to the first dealer or other person who offers it for sale in our State. This causes no little difficulty when an unbranded New York or Ohio cheese reaches the wholesale dealer in this State. The laws of New York and Ohio cannot compel a cheese which is to be sent to Pennsylvania to be branded in any particular manner, for it would be an unwarranted interference with the inter-state com

merce act, but the Pennsylvania law will compel the dealer in our own State to see that the cheese is properly branded before he offers it for sale.

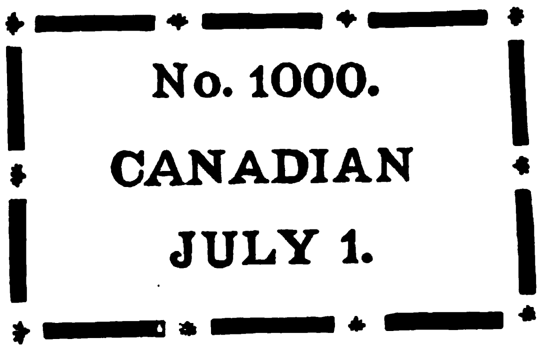
If our State law could be amended so that the brands of New York and Ohio could be accepted as a compliance with our own law, it would save much trouble and expense to wholesalers in this State, and at the same time protect the interest of the consumer quite as well; but in any event our law should be amended so as to correspond with those of Ohio and New York, at least in the style and number of grades of cheese made, and our next Legislature should see to it that our present law is simplified both as to its application and results, and so arranged as to inflict less expense and annoyance to dealers and retailers of cheese in Pennsylvania.

Before the date at which the law went into effect, meetings of the dealers in cheese in Philadelphia and Pittsburgh were held and were attended by the Dairy and Food Commissioner and myself; it was the desire of the dealers that they should be allowed to place their name and address upon the cheese and boxes, instead of that of the manufacturer who, in many cases at least, was located outside the State and unknown to those who proposed offering the cheese for sale. The officers of the Department expressed their willingness to make the enforcement of the law as easy and clear as was consistent with the interests of the consumer. A meeting of the representatives of the Philadelphia cheese dealers was held in the office of the Attorney General, and the whole matter of the enforcement of the law discussed, and that portion in regard to branding particularly presented; after due consideration the Deputy Attorney General rendered an opinion of which the following are the leading features:

"1. That, in case of cheese manufactured in Pennsylvania, you should require the same to be branded 'Full Cream,' 'Three-fourths Cream,' &c., as the case may be, and with the name and address of the manufacturer thereof."

"2. That, in case of small cheese, you should require the words "Full Cream,' 'Three-fourths Cream,' &c., to be printed in large letters and allow the name and address in smaller type, which, however should be clear and plain and which ought not to be less than one-half inch in height in any instance."

"3. In the case of cheese manufactured outside of the State, it would be sufficient compliance with the act of Assembly above named, if the dealer would brand the same in the manner indicated, with his name as dealer thereon, and with his address or place of business also thereon. I am fully convinced that in this way complete effect would be given to the act and the interests of the consumers as well as the Commonwealth would be best protected."



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CANADIAN AND OHIO CHEESE BRANDS.

NITRAGIN OR NITRIGINE.

The correspondence of the Department indicates that some of our farmers are becoming interested in this new candidate for agricultural favor, and it is to be regretted that, at least so far as this country is concerned, but little is known of its practical value, and not sufficient to warrant even a guess as to the results of its use.

It has long been known that, in some unexplained manner, clover and other members of the same family had the power of converting the free nitrogen of the air into forms in which it could, in some manner through the soil, be utilized as plant food, and it was equally well known that our ordinary grain crops did not possess this power but must, in great measure, depend upon nitrogen supplied through yard manure or commercial fertilizers.

It is now claimed that this class of plants have this power of action upon the free nitrogen of the air through bacteria which, under certain conditions and surroundings, collect among and around their roots.

It is claimed that these bacteria are present in what are termed rich soils and absent in poorer ones, and that, if not naturally present, they may be added artificially through the medium of preparations known as "Nitragin," or "Nitrigine." The theory at present receives its main force from the fact that the names of two foreign scientists of high degree (Nobbe and Hiltner) are associated with it.

The circulars through which "nitragin" is advertised, contain the following statements:

"1. Every single seed is surrounded with bacteria, which, after, germination, penetrate the roots, hairs and commence their role as collectors of nitrogen, so that a good crop is secured in the poorest soils without the use of nitrogenous manure.

"2. Through the storage of nitrogen by the bacteria, the soil itself becomes richer in nitrogen in an available state, to the advantage of other crops grown in rotation.

"3. The disadvantage of the mode of inoculation previously adopted is avoided.

"4. Manuring with nitrogen in the form of saltpetre ammonium salts, etc., is absolutely unnecessary."

Prof. Damascaux, of the Agricultural Institute of France, furnishes us with the following condensed answer as to what this new agent is and what it will do:

"The patent preparation named by Nobbe and Hiltner "nitragine,"

containing pure colonies of bacteria suitable for encouraging the combination of nitrogen of the air by leguminous plants (of the bean and pea family, including red clover) is erroneously called a bacilliary fertilizer. It is not a fertilizer in the strict sense of the term, but is a preparation containing minute living beings whose office is to convey to the soil, into which they are inoculated, the aptitude to produce clover, vetch, lupine, etc., etc.

"Whatever may be the manner of application, the object is to surround every seed with a colony of suitable bacteria, which, after germination, penetrates the root hairs and collects the free nitrogen of the air, so that, by their help, a good crop can be secured in a soil very low in nitrogen. In this way also the soil is enriched in available nitrogen through the storage of nitrogen by the bacteria, thus profiting the crops that follow, and diminishing the expenses due to providing the necessary nitrogen fertilizers."

Prof. W. A. Buckhout, of the Pennsylvania State College, in a paper prepared for the Department, thus alludes to this power possessed by red clover and crops belonging to the same family:

"While the structure and action of roots are in the great majority of plants such as have here described, there is one particular family, represented by such familiar kinds as the pea, the bean, the clover, etc., in which an entirely new feature appears, which, in the light of recent knowledge, is of unusual importance, and fits those plants which possess it to become singularly useful to mankind. It is their ability to form small nodules or tubercles. They appear early in the life of a root and under all ordinary circumstances. They are believed to be caused by microbes, perhaps a separate kind for each plant. The irritation produced in the root by these exceedingly minute organisms (for they are altogether too small to be seen except by the high power miscroscope) causes a wart-like enlargement, which soon comes to be much larger than the root itself. Within this tubercle the microbes live and thrive. Its cells soon become filled with them. In some way difficult to explain, if, indeed, it can be said to have been explained at all, they open up to the plants upon which they are growing the nitrogen supply of the atmosphere, and enable them to take and use it. Since other plants are thought not to have this power, it is obvious that all which bear these tubercles upon their roots have a great advantage and should have a large place in cultivation.

"They should require less aid from fertilizers and should be important members of any rotation. It thus becomes easy to understand the special value of clover, beans, peas and the like. They are not only valuable food-producing plants, but they tap sources of food not otherwise obtainable, and, whether used directly as food or merely for green fertilizers, they capture and fix the element, nitrogen, which is of prime importance to life and growth.

"It is the endeavor to hasten and make more certain the production of these tubercles upon the roots of leguminous plants and thus reap the benefit which accrues, that has led to the recent proposition to inoculate soils, particularly such as are new to cultivation or have been found ill adapted to growing tubercle bearing plants. The material used for such inoculation—called "nitragin" — is to be derived from the special cultivation of the tubercle microbes in particular media, such as gelatin, as is commonly done in bacteriological laboratories, thus securing a solution rich in them, so that when applied to the soil they shall be there in such numbers and activity that the roots of the young plants will become quickly infected, and thus their vigor enhanced by the nitrogen of the air unlocked for their use. Time and experience alone can tell how practicable is this method which theoretically commends itself."

In this, as in every new thing pertaining to agricultural improvement, we find the French agricultural chemists leading the van, and the French agricultural press contain advertisements of the new agricultural agency, which has as yet scarcely been tried in this country.

Such advertisements give explicit directions for the application of the new element. The proper kind for each plant is offered for sale in bottles, marked with peculiar colored labels for each crop, and accompanied with plain directions for its use. They also direct attention to the failure which will follow the use of the material prepared for one crop on another. The contents of the bottle must be carefully protected from any great increase in temperature, for it is found that much above the heat of the human body endangers the life of the bacteria.

The contents of the bottle, diluted with warm water, are to be carefully poured over the seed to be acted upon, and it is carefully stirred until every particle of the surface of the seeds is touched with the liquid, and the seed then sown and covered in the usual manner after sowing and before the heat of the sun has had time to injure the bacterial life. In some cases it is advised to dry the moistened seeds with a small portion of dry earth, but in other cases no account is made of this protection.

Prof. Duggar, of the Alabama Experiment Station, after a series of experiments with "nitragin," thus explains the theory of its effects and action:

"Nearly every genus of leguminous plants has its own specific "adapted" germ, which, if present in the soil or on the seed sown, is able to cause the development of these tubercles and to secure to the plant the consequent advantages. As a general rule, to which there are exceptions, the germ which induces the growth of tubercles on one legumen is unable, at least temporarily, to produce tubercles on plants belonging to other genera; for example, the germ which causes tu-

bercles on clover is impotent on vetch. Hence, for the thrifty growth of a given legumen, say clover, the soil must contain the corresponding form of germ life. If this 'clover germ' is absent, the only way to successfully grow clover on poor and medium soils is to use liberal quantities of nitrogenous fertilizers, an expensive operation. If the proper germs are present and if all other conditions are favorable, as drainage, proper mechanical condition and a sufficiency of phosphoric acid, potash and lime, clover plants will thrive and be largely independent of the soil nitrogen, drawing a large part of their supply from the atmosphere.

"Are most soils naturally stocked with the micro-organisms necessary to the thrifty growth of every kind of cultivated leguminous plants? Our experiments, of which a part are recorded in this bulletin, show that in some southern soils the germs essential to the thrifty growth of certain legumens are wanting or else present in insufficient number. Their absence from many southern soils explains why the opinion is so prevalent that in some localities that the clovers are not suited to the extreme south."

The fact that the experiments of the Alabama Station were nearly all conducted with species of the legumen family not cultivated in the north, robs their results of much of their value to us, but enough has been proven to show that the experiment is worthy of further investigation, and no doubt our northern experiment stations will take the matter up and test the theory upon the more commonly cultivated clovers and leguminous plants.

BEET SUGAR.

Correspondence from Montgomery, Cumberland, Greene, Wayne and Erie counties indicates that the question of the production of beet sugar in Pennsylvania is again attracting attention and that there is some disposition on the part of the farmers to make an examination into the question of cost and profit, and it is to be regretted that the Department is not in the possession of any recent data from which to furnish information.

In 1877 a similar interest was shown in Chester, Delaware and other southeastern and southern counties of the State, and the writer then. as the representative of the State Board of Agriculture, was in a position to be able to give some assistance in the way of analyses of samples of beets of different kinds grown under the same conditions

and of different kinds grown under different conditions. Over forty analyses were made of samples raised on the Eastern Experimental Farm, in Chester county, and by members of the Experimental Farm Club, which met there.

Of the theory of sugar beet production (for the sugar only) Prof. Goessman writes as follows: "The rules by which beets are successfully raised for feeding purposes do not apply to a successful production of the beet for sugar. In the first case quantity is the main aim; in the second, besides quantity, a good quality is essential. A good sugar beet is expected to contain not less than twelve per cent. of sugar, a small percentage of saline substance and the least possible amount of nitrogenous constituents. The more nitrogenous compounds there are present the less sugar will be noticed, for they exert a controlling influence on the formation of sugar in growing beet sugar. The saline substances, on the other hand, do not affect injuriously the formation of sugar, yet they place it under very disadvantageous circumstances, as far as its final separation in a crystalized form is concerned. They favor the production of molasses, and thus increase the expenses of manufacture. The history of the beet sugar industry of later years is not without many illustrations of these damaging experiences. Some late experiments in this country no doubt owe their failure, in part at least, to the fact that virgin soil, rich in vegetable mold and saline constituents has been used for the cultivation of the sugar beet. Judging from analogy, we cannot but consider the reported gigantic roots and unusually large crops per acre as unfavorable features of some recent attempts in beet sugar manufacture."

Although I have watched the various attempts to make the production of sugar from the beet profitable during the past twenty years, I have thus far received no information which leads me to very materially alter or amend the opinion expressed in my annual report of 1877 to the State Board of Agriculture (page 201). It is true that the introduction of centrifugal and other improved machinery may have so altered the relative conditions so as to reduce the cost of manufacture, but experiments will soon demonstrate this. It is also possible that, by a careful selection of seed and soil we can so increase the percentage of sugar and decrease that of impurities as to make the crop profitable, but thus far no practical experiments in our own State have proven this.

In 1877 I wrote as follows:

"It has been demonstrated that if the percentage of sugar in the roots does not come up to a certain point, its manufacture will not prove profitable. Let us then first establish the fact that there are at least special soils in Pennsylvania which will grow beets having the required percentage of sugar, and next that its manufacture will pay.

and capital will not long be wanting. It will not do to assume that because this industry is found profitable in France and Germany, or even in California, that it will be equally lucrative in Pennsylvania. If mere bulk of roots was all that is needed we should have no fears of the success of the enterprise, but this is far from being the primary consideration. If, on the other hand, we attempt its manufacture from roots not rich enough in the sugar producing elements and depend upon State bounty to furnish the balance between cost and the actual market value of the sugar, we shall find that as soon as this aid is withdrawn the industry will fail. It would be better not to start at all than to commence upon a false basis and rear upon it a fabric which will eventually fall, if from no other cause, because of the insecure foundations. The assumption that Pennsylvania can grow beets rich in sugar is as yet unsupported by that kind of proof that is absolutely necessary before capital can be induced to lend its aid. We have no desire to discourage any attempts which have been made or which are being made to place this industry on the list with many others which have given our State her present position among her sister states, but it is our desire to have no false steps made."

In the same report from which the above quotation is taken, I find the following relating to the importance of the manufacture of sugar to the United States, written by Lea Pusey:

"In 1847 the gold mines of California were discovered, and the silver mines soon after. Since their discovery (up to 1877), the amount of both mined in that region is very near $1,000,000,000. It would be natural to suppose that from such a vast sum we would have retained an ample sufficiency. But such is not the fact. And why? One of the most prominent reasons is that during that period we have imported and consumed over $1,250,000,000 worth of sugar. While we have squandered our gold for sugar, France, by preserving, in a wise policy of the protection of this industry (beet sugar manufacture) for the national benefit, has for the last ten years produced sufficient sugar for home consumption, and now is exporting a large surplus, and without any mines of gold or silver, possesses to-day, according to the best authority, over $1,200,000,000 of the precious metals, of which $360,000,000 has been accumulated during the last seven years, and after paying an unprecedented indemnity to Germany within that time."

Recent experiments have proven that beets can be raised in this State which show over eighteen per cent. of sugar, but such cases are rather the exception than the rule, and from results attained within the past year in our own State, we infer that the average percentage of juice has not exceeded 12. The extremes reported by our Experiment Station are stated as being 18.8 and 6.85, the average being 12.45 per cent.

During the year 1877 the Eastern Experimental Farm Club met

semi-monthly at the Eastern Experimental Farm in Chester county; the club resolved to institute a series of careful experiments, having for their object the production of beets for sugar rather than for stock, and were promised the co-operation of the State Board of Agriculture in the work. A large amount of seed of different varieties was procured and distributed among its members and selected roots produced from this seed were sent to the State Board of Agriculture to be tested for their sugar contents. From the result of this test, as shown by the following tables, it will be seen that, taking Dr. Goessman's estimate of twelve per cent. as necessary for profit, the product was not sufficiently rich in sugar to warrant any attempt at manufacture. I have followed the table by a condensed statement showing just how much each crop represented in the test produced, and from the table following the report it will be noted that there was no trouble in obtaining a large crop of beets. The tables are as follows:

Number.	Kind of Seed	Per cent. of total solids in juice.	Per cent. of sugar in juice.	Per cent. of impurities in juice.	Per cent. of sugar and total solids.
1	Vilmorin,	15	11.4	3.6	76
2	Quidlinberger,	11	7.6	3.4	60
4	White Silesian,	10.5	6.9	3.6	65
5	White Silesian,	10.5	6	4.5	65
6	White Silesian,	10.5	6	4.4	57
7	White Silesian,	10	6.4	3.6	64
8	Imperial,	11	8	3	72
9	Imperial,	11	7.7	3	70
10	Vilmoron,	13	9.6	3.4	74
11	Quidlenberger,	10.5	7.7	2.8	73
12	Carter's Prize,	12.5	9.4	3.1	75
13	Breslau,	10	8.4	1.6	84
14	Carter's Prize,	10.5	6	4.6	57
15	Quidlenberger,	10	6.5	3.5	65
16	Imperial,	10	6.4	3.6	64
17	Vilmorin,	10	4.9	3.1	69
18	Breslau,	9	6.3	2.7	70
19	White Silesian,	10	5.5	4.5	55
20	Long Blood,	9	6.4	3.1	67
21	White Silesian,	9	5.2	3.8	58
22	White Silesian,	9.5	5	4.5	52
23	White Silesian,	10.5	5.5	5	52
24	White Silesian,	9	5.4	3.6	60
25	White Silesian,	8.5	4.7	3.8	55
26	White Silesian,	10	6.4	....	....
27	White Silesian,	11	6.7	4.3	60
28	White Silesian,	11	7.4	3.6	67
29	White Silesian,	10.5	7.8	2.7	74
30	White Silesian,	11	7.4	3.6	67
31	White Silesian,	10.5	6.9	3.6	65
32	White Silesian,	8	5.4	2.6	67
33	White Silesian,	11	6.9	4.1	63
34	Imperial,	7.5	4.1	3.4	54
35	White Silesian,	11	5.7	5.3	52
36	White Silesian,	10	6.4	3.6	64
37	Carter's Prize,	12	7.4	4.6	62
38	White Silesian,	9.5	5.2	4.3	55
39	White Silesian,	9.5	5.2	4.3	55

These samples were grown under the following conditions:

1. Grown by Charles Ramsey; sandy loam sub-soil; barn-yard manure, plowed under in the spring, bone in the row; previous crop for two years, melons; harvested, September 30.

2. Same soil and same treatment as No. 1.

4. William Rutherford; clay loam; barn-yard manure, plowed in; planted May 30, harvested, October 12.

5. N. J. Sharpless; agrillaceous loam, clay sub-soil; in potatoes previous year; twelve cords of barn-yard manure per acre, plowed in; planted May 28, harvested October 11.

6. N. J. Sharpless, same soil as No. 5; no yard manure; equal parts by bulk of bone, plaster and manure from chicken house, at the rate of one and one-half tons per acre; planted and harvested the same time as No. 5.

7. William Swayne; strong limestone loam; Coe's phosphate, manure from the chicken house and ground bone in equal bulk, at the rate of six hundred pounds per acre, harrowed in; planted May 11, harvested October 1.

8. Same as No. 7.

9. Same as No. 7, but no fertilizer.

10. Same as No. 9.

11. Same as Nos. 9 and 10.

12. Same as last specimens.

13. Same as last specimens.

14. Experimental Farm; mocaceous loam, porous sub-soil; phosphate, plowed in; planted May 26, harvested October 13.

15. Same as 14.

16. Same as 14.

17. Same as 14.

18. Same as 14.

19. Same as 14.

20. Same as 14.

21. Experimental Farm, micaceous soil, porous sub-soil; fertilized with $10.00 worth of Challenge phosphate (High Grade rock).

22. Fertilized by Lenning's phosphate.

23. Fertilized by ground bone; cost $10.00.

24. Fertilized by sulphate of potash; cost $10.00.

25. Fertilized by muriate of potash; cost $10.00.

26. Fertilized by Popplein's truck phosphate; cost $10.00.

27. Fertilized by AA nitrogen; cost $10.00.

28. Fertilized by nitrate of soda.

29. No fertilizer.

30. Fertilized by Pacific Guano; cost $10.00.

31. Fertilized by sulphate of ammonia; cost $10.00.

32. Fertilized by Stockbridge's manure; cost $10.00.

33. C. C. Hood; clay loam; cropped with potatoes for two years; hog pen manure in the row; planted May 18, harvested October 11.

34. Same as 33.

35. David C. Swayne; clay loam, flint and slate; two years with corn; manure from chicken house.

36. George Balderston; clay loam; flint and gray stone, land thin.
37. Same as 36.

In order to test the comparative yields of the different varieties, Superintendent Carter gave each kind, as nearly as possible, the same treatment and management, and the following were the resultant crops:

Carter's Prize,	13 tons, 1,001 pounds.
Quidlinberger,	12 tons, 388 pounds.
Imperial,	10 tons, 33 pounds.
Vilmoron,	8 tons, 549 pounds.
Breslau,	9 tons, 1,162 pounds.
White Silesian,	9 tons, 724 pounds.
Long Blood Red,	5 tons, 887 pounds.
Yellow Globe,	7 tons, 1,240 pounds.

Prof. Goessman, at the time of the experiment, made the following statement: "Every cent of increase in the price of sugar (per pound) would be equal to $15.00 per acre, and every half cent increase in crystalized sugar from every hundred pounds of beets worked, would add 115 pounds to the yield and $8.05 additional per acre. These additions, to profit are by no means beyond reach, for the best management in Europe realizes them."

When the above statement was made beet sugar was valued at seven cents per pound, and an allowance must, of course, be made when the present prices are taken into consideration.

Fearing that, taking the price of sugar into consideration, Dr. Goessman's estimate of 12 per cent. might not suit the change in prices, I wrote to Dr. William Frear, chemist of the Department, and from his reply, take the following:

"If we would compete with Europe, we must make our sugar at as low a cost. Since the price of our labor is higher—much of the harvesting being performed by women and children at 15 cents per day, and men's labor in proportion—we must be able to work with as little comparative disadvantage as possible as regards other items of expense.

"It is, indeed, not needful that every beet should contain 12 per cent., but the average richness must be about the same here as in Europe.

"Mayer gives the average of the principal sugar countries of Europe as follows: Austria, 12.9 per cent.; France, 13.9 per cent., and Germany, 14.5 per cent.

Goessman is evidently not too high. There was a time when the high price of sugar made it possible to work 8 to 10 per cent. beets with profit, but that time is past.

"You are right in noting that only saccharine richness, but other

qualities are needful in a beet. Of the solids in the juice, at least 78 to 80 per cent. should be cane-sugar. The presence of much more than 20 per cent. (of the total solids) in the forms of material other than sugar induces undesirable decomposition of the sugar, and prevents much of the sugar from crystalizing."

One important item very often entirely lost sight of in estimates of the cost of beet sugar production is the effect produced upon the extraction of the sugar by the impurities which often exist in the juice. Accepting the statement that one per cent. of impurity will neutralize one per cent. of sugar, we may obtain some interesting results from the table representing the analyses of the roots raised during the experiment of the Experimental Farm Club, and the same reasoning will apply with equal force to experiments now being made. Comparing the results of the analyses of Nos. 12 and 13, we find that the former gave 9.4 of sugar and 3.1 of impurities; this, applying the above rule, would leave 6.3 for actual sugar produced. In No. 13 the percentage of sugar was 8.4 and of impurities 1.6; applying the above rule to this sample, it follows that there would be 6.8 left for actual sugar, thus showing that it is possible that a lower grade of beet or one not so rich in sugar (but above in impurities), may produce the most sugar, and hence, it follows that in the production of sugar for beets, we must study the comparative content of sugar and impurities and that, if safe results are to be attained, both must be considered together and that, if results are based upon sugar content alone, disappointment may follow and the experiment end in disaster.

As showing the extent to which this industry is followed in Europe. the following statistics of last year are interesting:

Germany—379 factories; 11,675,000 tons of beets grown on 930,372 acres, or at the rate of 2,348 acres to each factory.

France—950 factories; 5,411,484 tons of beets grown on 405,852 acres, or at the rate of 1,140 acres for each factory.

Austria—216 factories; 5,700,000 tons of beets.

Russia—277 factories, with 5,311,000 tons of beets.

In Germany, the average price paid for roots appears to have been $4.64 per ton.

BUTTER-FAT IN CHEESE.

The passage of the act of June 23, 1897 (to prevent fraud and deception in the manufacture and sale of cheese, etc.). brought a large amount of additional correspondence to the Secretary of the Depart-

ment. This, after classification, was reduced to the following topics. or items:

1. That it would be impossible for the wholesale dealer to comply with the requirements of the law with regard to placing the name and address of the manufacturer upon the cheese and box, because, in many cases, the dealer bought the cheese of a large number of factories and often did not know from which one a particular cheese came.

2. That the standard of 32 per cent. of butter-fat, for a full cream cheese, was too high, and could never be reached in the ordinary course and manner of manufacture.

3. That samples taken from different portions of the same cheese would show variations in the amount of butter-fat of sufficient amount to acquit or convict those charged with a violation of the law.

4. That different days' work by the same factory, even under as nearly the same conditions and surroundings as possible, would vary in their content of butter-fat sufficiently to convict or acquit offenders.

5. Nearly all grocers remove the band which is around the cheese before they cut, and if the cheese is branded, as required by law, on "two sides," the brand is thus taken off with the band and neither the customer nor the special agent of the Department has any proof of a compliance with the requirements of the law.

Several meetings of cheese manufacturers and dealers were held in different portions of the State and were attended by the Secretary of the Department for the double purpose of explaining the construction placed by the Department upon the law, and of obtaining the views of practical manufacturers of and dealers in cheese. At all such meetings the Department was able to meet the manufacturers and dealers fully half way in all essential particulars, and all concessions within the letter of the law were granted.

As an offset to the first claim, the Department argued that it was to the interest of the manufacturer to comply with the law, and that the probable result of the enforcement of the law would be that the retail dealer would only purchase of such manufacturers or wholesale dealers as did comply with the requirements of the law.

It was admitted by the Department that the provisions of the inter-state commerce law would prevent the application of this provision of the law to non-resident manufacturers, and that the decisions under the inter-state commerce act would protect all cheese made outside the State to its first sale or offer to sell within the State, but that, on the article being sold, or offered for sale in the State, either wholesale or retail, the provisions of the enactment of the Legislature would at once take effect and the seller become liable for the full penalty prescribed by the act.

This decision of the Department was based upon the decisions in

the cases of Commonwealth vs. J. Otis Paul, Commonwealth vs. Powell and Commonwealth vs. Schollenberger, in which it was decided, in effect, that the provisions of the inter-state commerce law protected articles to their place of destination in the State and to their first sale, or offer to sell, but that after that point, they became liable to the police regulations of the State Government. This view of the case having the endorsement of the Attorney General, it was given as the decision of the Department which would, so far as suits were concerned, rule until reversed by the courts by test cases under the cheese law.

The difficulty of branding the cheese of distant or non-resident manufacturers was admitted and its application to cheese importers from foreign countries was evidently a still stronger case of hardship. As applicable to the case of imported (foreign) cheese, the Department, with the advice of the Deputy Attorney General, ruled that the name and address of the wholesale dealer or importer would comply sufficiently with the spirit of the law.

In order to settle, in a practical manner, the question of fact as to whether the standard of 32 per cent. of butter-fat in a full cream cheese was impracticable, Profs. Aschman, Frear and Cochran were directed to have 100 samples of cheese selected in their respective districts and have them carefully tested for their percentage of butter fat, and it was agreed by all parties interested that the result of this test should be deemed conclusive. Before the test was made, the wholesale dealers receded from their claim and admitted that the presence of 32 per cent. of butter-fat was readily attained, and that in some cases an even higher rate would be found.

The results of the analyses of Profs. Aschman, Frear and Cochran are given, in detail, in the following tables, from which it will be noted that while a number of samples run below the full cream standard. there is evidence for the belief that they were in reality "skim-milk" cheese and would come under one of the lower classifications of the law, but few falling below that of "three-fourths cream," which requires the presence of 24 per cent. of butter-fat, and that none fell below the requirements of a "half cream cheese," which, according to the provisions of the act, must have not less than 16 per cent. of butter-fat.

The attention of the reader, in his examination of the tables, is called to the fact that the samples were selected in the open market from the counters of retail dealers, and no effort was made to distinguish between the full cream and skim-milk cheese, and that it is but fair to presume that a full proportion of the latter are represented in each of the three lists.

ANALYSES OF SAMPLES BY PROF. F. T. ASCHMAN, AND SELECTED IN WESTERN PENNSYLVANIA.

Number of sample.	Place of Selection.	Per cent. of butter-fat.	Number of sample.	Place of Selection.	Per cent. of butter-fat.
7571,	Pittsburgh,	30.16	7640,	Erie,	31.86
7572,	Pittsburgh,	34.51	7641,	Erie,	33.27
7573,	Pittsburgh,	37.91	7642,	Erie,	30.61
7574,	Pittsburgh,	35.29	7634,	Erie,	34.76
7575,	Pittsburgh,	34.86	7644,	Erie,	27.48
7576,	Pittsburgh,	35.22	7623,	Greensburg,	33.34
7577,	Pittsburgh,	31.54	7624,	Greensburg,	23.48
7578,	Pittsburgh,	27.63	7625,	Greensburg,	30.88
7579,	Pittsburgh,	36.01	7626,	Greensburg,	31.51
7580,	Pittsburgh,	35.71	7627,	Greensburg,	32.76
7599,	Pittsburgh,	29.51	7615,	Johnstown,	35.65
7600,	Pittsburgh,	31.37	7616,	Johnstown,	30.17
7601,	Pittsburgh,	30.99	7617,	Johnstown,	25.76
7602,	Pittsburgh,	30.92	7618,	Johnstown,	32.14
7603,	Pittsburgh,	35.48	7619,	Johnstown,	36.28
7061,	Pittsburgh,	37.15	7557,	Sharon,	36.16
7605,	Pittsburgh,	29.68	7558,	Sharon,	35.09
7606,	Pittsburgh,	29.68	7559,	Sharon,	34.51
7629,	Pittsburgh,	30.83	7560,	Sharon,	37.36
7633,	Pittsburgh,	32.44	7645,	Meadville,	37.31
7634,	Pittsburgh,	36.17	7646,	Meadville,	36.82
7638,	Pittsburgh,	31.94	7647,	Meadville,	29.47
7561,	Washington,	32.46	7635,	New Castle,	35.42
7562,	Washington,	35.51	7636,	New Castle,	31.13
7363,	Washington,	25.24	7637,	New Castle,	29.67
7564,	Washington,	28.86	7621,	Latrobe,	36.38
7565,	Washington,	30.37	7622,	Latrobe,	30.93
7566,	Washington,	28.93	7623,	Latrobe,	35.38
7567,	Washington,	30.19	7613,	Beaver,	31.17
7568,	Washington,	31.79	7614,	Beaver,	30.29
7569,	Washington,	30.86	7609,	Beaver,	40.39
7570,	Washington,	37.14	7610,	Beaver,	32.04
7589,	Allegheny,	30.77	7607,	Rochester,	32.28
7590,	Allegheny,	32.68	7608,	Rochester,	33.81
7591,	Allegheny,	33.87	7630,	Irwin,	29.59
7592,	Allegheny,	32.78	7631,	Irwin,	33.79
7593,	Allegheny,	29.21	7630,	Irwin,	29.59
7594,	Allegheny,	36.29	7650,	Oil City,	34.50
7595,	Allegheny,	35.11	7651,	Oil City,	33.83
7596,	Allegheny,	33.59	7652,	Butler,	30.0)
7597,	Allegheny,	33.87	7653,	Butler,	36.51
7598,	Allegheny,	35.88	7654,	Butler,	31.51
7581,	Braddock,	31.88	7612,	New Brighton,	37.93
7582,	Braddock,	31.29	7611,	New Brighton,	34.37
7583,	Braddock,	36.84	7648,	Franklin,	36.05
7584,	Braddock,	31.37	7649,	Franklin,	31.29
7585,	Braddock,	29.93	7628,	Jeannette,	32.94
7586,	Braddock,	31.48	7620,	Derry,	32.47
7587,	Braddock,	39.71			
7588,	Braddock,	38.6)			
7639,	Erie,	35.44		Average,	32.60

Analyses of Samples of Cheese by Dr. William Frear, from Samples Selected in the Interior of Pennsylvania.

Number of sample.	Place of Selection.	Per cent. of butter-fat.	Number of sample.	Place of Selection.	Per cent. of butter-fat.
1,	Lewisburg,	32.17	53,	Altoona,	38.70
2,	Lewisburg,	32.85	54,	Altoona,	36.90
3,	Lewisburg,	31.05	55,	Altoona,	37.85
4,	Lewisburg,	34.65	56,	Altoona,	33.53
5,	Lewisburg,	32.40	57,	Altoona,	35.55
6,	Sunbury,	33.30	58,	Altoona,	31.73
7,	Sunbury,	33.08	59,	Altoona,	35.78
8,	Sunbury,	34.20	60,	Altoona,	34.88
9,	Sunbury,	33.75	61,	Altoona,	36.68
10,	Sunbury,	31.95	62,	Altoona,	34.43
11,	Sunbury,	33.08	63,	Altoona,	33.25
12,	Sunbury,	32.40	64,	Altoona,	36.00
13,	Sunbury,	34.88	65,	Altoona,	29.25
14,	Sunbury,	30.83	66,	Bellefonte,	36.00
15,	Sunbury,	32.63	67,	Bellefonte,	34.20
16,	Williamsport,	36.45	68,	Bellefonte,	36.23
17,	Williamsport,	35.10	69,	Bellefonte,	37.90
18,	Williamsport,	34.43	70,	Bellefonte,	37.13
19,	Williamsport,	33.53	71,	Lemont,	39.60
20,	Williamsport,	33.75	72,	Lemont,	39.83
21,	Williamsport,	32.17	73,	State College,	37.35
22,	Williamsport,	31.95	74,	State College,	37.35
23,	Williamsport,	33.53	75,	State College,	34.88
24,	Williamsport,	31.50	76,	Wilkes-Barre,	36.00
25,	Williamsport,	35.78	77,	Wilkes-Barre,	39.38
26,	Williamsport,	34.65	78,	Wilkes-Barre,	38.25
27,	Williamsport,	33.75	79,	Ashley,	32.25
28,	Williamsport,	34.65	80,	Ashley,	33.08
29,	Williamsport,	34.88	81,	Wilkes-Barre,	35.23
30,	Williamsport,	31.95	82,	Kingston,	39.83
31,	Williamsport,	39.60	83,	Kingston,	36.68
32,	Williamsport,	35.55	84,	Kingston,	34.20
33,	Williamsport,	37.13	85,	Edwardsville,	38.25
34,	Williamsport,	34.65	86,	Wilkes-Barre,	36.00
35,	Williamsport,	35.10	87,	Wilkes-Barre,	37.80
36,	Williamsport,	34.65	88,	Wilkes-Barre,	40.95
37,	Williamsport,	33.53	89,	Wilkes-Barre,	36.00
38,	Williamsport,	32.85	90,	Wilkes-Barre,	37.58
39,	Williamsport,	37.13	91,	Wilkes-Barre,	36.90
40,	Williamsport,	35.55	92,	Wilkes-Barre,	34.65
41,	Tyrone,	34.20	93,	Wilkes-Barre,	37.58
42,	Tyrone,	35.51	95,	Wilkes-Barre,	34.43
43,	Tyrone,	34.20	96,	Wilkes-Barre,	34.65
44,	Tyrone,	29.93	97,	Wilkes-Barre,	36.23
45,	Tyrone,	35.10	98,	Wilkes-Barre,	36.23
46,	Altoona,	37.25	99,	Wilkes-Barre,	38.70
47,	Altoona,	36.45	100,	Wilkes-Barre,	38.70
48,	Altoona,	36.23			
49,	Altoona,	31.95			
50,	Altoona,	40.05			
51,	Altoona,	33.75			
52,	Altoona,	39.83		Average,	35.30

Analyses of Samples of Cheese by Prof. C. B. Cochran, Selected in the Eastern part of Pennsylvania.

Number of sample.	Place of Selection.	Per cent. of butter-fat.	Number of sample.	Place of Selection.	Per cent. of butter-fat.
1,	West Chester,	31.71	79,	Philadelphia,	34.85
2,	West Chester,	35.87	80,	Philadelphia,	32.42
3,	West Chester,	34.11	81,	Philadelphia,	34.14
4,	West Chester,	41.52	82,	Philadelphia,	31.15
5,	West Chester,	39.73	83,	Philadelphia,	31.36
6,	West Chester,	36.80	84,	Philadelphia,	35.51
7,	West Chester,	36.05	85,	Philadelphia,	29.23
8,	West Chester,	33.69	86,	Philadelphia,	29.35
9,	Philadelphia,	34.61	87,	Philadelphia,	33.90
10,	Philadelphia,	36.40	88,	Philadelphia,	33.46
11,	Philadelphia,	33.51	89,	Philadelphia,	33.90
12,	Philadelphia,	33.89	90,	Philadelphia,	32.65
13,	Philadelphia,	34.70	91,	Philadelphia,	34.86
14,	Philadelphia,	36.09	92,	Philadelphia,	23.92
15,	Philadelphia,	35.87	93,	Philadelphia,	28.39
16,	Philadelphia,	33.89	94,	Philadelphia,	28.39
17,	Philadelphia,	33.64	95,	Philadelphia,	32.68
18,	Philadelphia,	32.33	96,	Philadelphia,	34.74
19,	Philadelphia,	32.81	97,	Philadelphia,	32.90
20,	Philadelphia,	32.45	98,	West Chester,	32.84
21,	Philadelphia,	34.57	99,	West Chester,	33.33
22,	Philadelphia,	33.16	100,	West Chester,	33.80
23,	Philadelphia,	34.43	59,	Coatesville,	33.30
24,	Philadelphia,	33.20	60,	Coatesville,	33.90
25,	Philadelphia,	30.20	61,	Coatesville,	35.61
26,	Philadelphia,	32.14	62,	Coatesville,	34.35
27,	Philadelphia,	35.05	63,	Coatesville,	33.72
28,	Philadelphia,	33.94	64,	Coatesville,	32.65
29,	Philadelphia,	32.88	65,	Coatesville,	36.30
30,	Philadelphia,	36.19	66,	Coatesville,	34.30
31,	Philadelphia,	35.50	67,	Coatesville,	23.04
32,	Philadelphia,	35.56	68,	Coatesville,	33.48
33,	Philadelphia,	31.61	69,	Coatesville,	36.21
34,	Philadelphia,	34.89	56,	Downingtown,	34.15
35,	Philadelphia,	32.81	57,	Downingtown,	32.04
36,	Philadelphia,	34.74	58,	Downingtown,	38.76
37,	Philadelphia,	39.42	70,	Downingtown,	33.06
38,	Philadelphia,	32.50	71,	Downingtown,	32.02
39,	Philadelphia,	32.06	72,	Downingtown,	31.20
40,	Philadelphia,	33.12	73,	Downingtown,	35.80
41,	Philadelphia,	34.52	74,	Downingtown,	34.12
42,	Philadelphia,	32.14	101,	Harrisburg,	36.81
43,	Philadelphia,	29.00	102,	Harrisburg,	34.21
44,	Philadelphia,	35.03	103,	Harrisburg,	34.35
45,	Philadelphia,	34.70	104,	Harrisburg,	35.61
46,	Philadelphia,	37.20	105,	Harrisburg,	35.29
47,	Philadelphia,	31.35	106,	Harrisburg,	34.04
48,	Philadelphia,	36.13	107,	Harrisburg,	35.00
49,	Philadelphia,	30.48	108,	Harrisburg,	36.16
50,	Philadelphia,	36.30	109,	Harrisburg,	33.41
51,	Philadelphia,	34.87	110,	Harrisburg,	32.94
52,	Philadelphia,	28.74	111,	Harrisburg,	28.63
53,	Philadelphia,	34.90	112,	Harrisburg,	34.77
54,	Philadelphia,	33.07	113,	Harrisburg,	28.06
55,	Philadelphia,	33.90	114,	Harrisburg.	33.93
75,	Philadelphia,	35.05	115,	Harrisburg,	32.55
76,	Philadelphia,	33.80			
77,	Philadelphia,	31.50			
78,	Philadelphia,	32.88		Average,	33.60

In order to fairly test the claim that samples taken from different portions of the same cheese would show sufficient variation to convict or discharge an offender against the law, Profs. Aschman, Frear and Cochran were directed to conduct three entirely independent series of analyses, from samples selected under their own supervision.

Prof. Aschman obtained a series of samples as follows: "The samples were taken from a slice of the cheese cut entirely across the cheese, and are marked, beginning on one side and in regular sequence." The rind was discarded as likely to improperly influence the result. Prof. Aschman's reports of this test are as follows:

Sample A,	33.61
Sample B,	32.96
Sample C,	32.65
Sample D,	33.17
Sample E,	32.75
Sample F,	32.63
Sample G,	32.62

The maximum result is 33.61; the minimum result is 32.62; the average result is 32.92; the variation between the maximum and minimum results is 0.99; the variation between the maximum and average results is 0.66; the difference between the minimum and average results is 0.29. An analyses of the thin slices discarded as the "rind," showed 40.34 of butter-fat, indicating that the rind had absorbed some of the oily material with which the cheese had been rubbed.

Another test made by Prof. Aschman, from samples taken in a similar manner, but from another cheese, gave the following results:

Sample A,	35.29
Sample B,	34.16
Sample C,	34.66
Sample D,	34.74
Sample E,	35.23

The average of the above samples indicates 34.81 of butter-fat, and Prof. Aschman found that a sample formed by mixing them all together gave 34.72 actual test.

A third test, by the same chemist, from a sample from another cheese, the slice being taken in a line across the cheese and the individual samples by cross sections, gave the following results:

Sample A,	36.11
Sample B,	35.67
Sample C,	35.76
Sample D,	35.98

The first test by Dr. Frear was made from samples selected as follows:

"The samples were selected so that no portion of their surface, except the rind, had been exposed to the air. The samples were cut so as to separate the rind at the outer edge and to divide the remainder

of the slice into three vertical sections. All of these sections were then equally sub-divided into upper and lower portions. The rind was in each case about an inch in thickness."

The results of these two tests made in this way were:

Sample A.	Inner Section.	Middle Section.	Outer Section.	Rind.
Upper half, ...	35.55	36.45	37.13	40.05
Lower half, ...	36.90	36.00	36.90	40.27

Sample B.	Inner Section.	Middle Section.	Outer Section.	Rind.
Upper half, ...	36.45	36.45	36.45	42.32
Lower half, ...	36.90	36.45	36.45	41.40

In a test made by Prof. Cochran, a sample was taken from the outer surface to the centre of a large cheese. The rind was discarded and the section divided into four samples at right angles to its position in the cheese. The results were as follows:

Sample A, ...	34.65
Sample B, ...	33.76
Sample C, ...	33.54
Sample D, ...	33.96

Another test by the same chemist, but from another cheese, gave as results:

Sample A, ...	33.75
Sample B, ...	33.94
Sample C, ...	32.88
Sample D, ...	33.37

A third test by the same chemist, but from another cheese, gave:

Sample A, ...	34.20
Sample B, ...	33.85
Sample C, ...	33.42
Sample D, ...	33.21

In order to have a fair and impartial test of the question of the variation of different days make of cheese under practically the same condition, Hon. J. B. Phelps, of Conneautville, Crawford county, Pa., was requested to take samples from any ten days consecutive production of his factory and forward them to Prof. F. T. Aschman, of Pitts-

burgh; the analyses were carefully made by Prof. Aschman and show the following percentage of butter-fat:

July 21,	41.77
July 22,	42.36
July 23,	42.67
July 24,	39.89
July 25,	41.77
July 26,	40.38
July 27,	43.31
July 28,	42.25
July 29,	39.79
July 30,	42.27

In this test the maximum amount of butter-fat was 43.31, the minimum amount was 39.89, and the average was 41.65; the variation between the maximum and the average was 1.66; the variation between the minimum and the average was 1.77; the variation between the maximum and minimum was 3.42.

It will be remembered that in this case Mr. Phelps was certain that he had a "full cream cheese" and in this connection the high percentages of butter-fat are a conclusive answer to the claim that the legal standard of 32 per cent. is not attainable; it should also be remembered that the samples were from "comparatively green" cheese, the last one having been made July 30, and the analyses made September 3, of the same year.

The results of the investigations made as above, enabled the Department to come to the following conclusions:

1. That the law does and cannot require impossibilities, and that therefore in the case of imported (foreign) cheese, the name and address of the importer or wholesale dealer will, as nearly as is practicable, fulfill the requirements of the law.

2. That the standard of 32 per cent. of butter-fat for a "full cream cheese" is not too high and is readily attainable by any careful and practical manufacturer, and that it is in favor of, rather than against the manufacturer.

3. That the slight variation in the amount of butter-fat in different portions of the same cheese, the rind being discarded, are not of sufficient amount to influence results, and that even this slight variation may be avoided by taking the samples with a cheese "trier" which ensures a fair section of the cheese.

4. That, under proper management, the variation caused by the milk of different days is not of sufficient importance to modify results, especially as it is not the intention of the Department to prosecute upon close or small margins.

5. The law does not state that the cheese must be branded upon the

band; the words of the act are "shall be branded or stenciled in ordinary bold faced capital letters, not less than one inch in height, on two sides of the cheese, and upon the top and bottom of the box or case containing the cheese;" the top and bottom are "two sides of" of the cheese and if properly branded or stenciled there, will sufficiently comply with the law; the objection that the brand may be removed with the portion of the cheese first sold, may be obviated by making it a rule to leave at least a portion of the brand upon the last piece.

The question of the percentage of butter-fat in imported (foreign) and fancy cheese having been raised, Prof. Aschman was directed to procure samples of this class of cheese and make a series of analyses; the results of this test are as follows:

No. 7655. Neufchatel Cheese, Domestic make, 20 cents per pound, 26.36.

No. 7656. Imported Limburger, 30 cents per pound, 33.81.

No. 7702. Framage de Isigny, American, 50 cents per pound, 21.62.

No. 7703. Parmisan Cheese, Italian, 40 cents per pound, 32.09.

No. 7704. Fromage de Roquefort, Imported, 35 cents per pound, 25.98.

No. 7705. Creme de Brie, French, 70 cents per pound, 25.15.

No. 7706. English Dairy Cheese, Imported, 25 cents per pound, 34.76.

No. 7707. Fromajo Romano, Italian, 30 cents per pound, 34.31.

No. 7708. Cachocavalla Cheese, Italian, 25 cents per pound, 27.31.

No. 7709. Fromage De Chemembert, French, 70 cents per pound, 25.29.

REPORT OF THE DEPUTY SECRETARY AND DIRECTOR OF FARMERS' INSTITUTES.

HARRISBURG, January 1, 1898.

HON. THOMAS J. EDGE, SECRETARY OF AGRICULTURE:

Dear Sir: The work of the Division of Farmers' Institutes for the past year has been quite satisfactory. As has been explained in a former report, the institute season does not correspond with the calendar year, but extends from the 1st of May to the 30th day of the following April. The necessity for this method of reporting is due to the fact that the institutes are held in the winter season, and a report made from January to December 31, would not give the operations of the institute year, and consequently would be incomplete.

The experience of the previous year, in which the institutes began in October, and continued until the middle of the following April, made it clear that the period in which institutes could be held with the greatest convenience and advantage to the farmers of the State, would have to be considerably shortened. The farm work in the late autumn, and the bad roads of the early spring often prevented many from coming to the institutes who would have been glad to have availed themselves of the opportunity, if these conditions had not interfered. Accordingly, the first meetings for the season of 1895-6, were set for November 4, and the last one for the 19th of March.

In order that it might be possible to hold the number of meetings arranged for in the time specified, it became necessary to divide the State into three districts, and appoint institute lecturers for each district. Three lecturers were in each division, one regular speaker who represented the Department of Agriculture, one scientific expert supplied by the State Experiment Station, and the third member who was a specialist in some line of agricultural practice. The third member of the force was changed from time to time, in order to have the advantage of fresh topics, and also to give opportunity for training some new men in the institute work. Quite a large percentage of these third men failed to appear, to the great inconvenience and disappointment of the managers. An effort will be made to remedy this in the future by securing a positive promise from each man who proposes to go on the force, that he will meet his engagements.

Eighty-two lecturers were on the list, constituting an array of talent not excelled by that of any other state in the Union. There were in all three hundred and eighty days of institute held during the season,

as against two hundred and sixty-four days the previous year, making a total for the two years of five hundred and seventy-two days, at a cost to the State of $15,000, which was the appropriation for institute work. This sum does not include the salary of the Director of Institutes or his travelling expenses. The expense per day, therefore, was about $26.00. Of the entire sum, $6,891.93 was handed over to the local managers in the several counties for local uses, and $8,108.07 went to the payment of State speakers, including their travelling expenses, hotel bills and salaries, making $12.00 expended by the local manager, and $14.00 expended by the Director of Institutes in supplying lecturers and meeting their expenses. About fifty thousand people were reached during the season. The total number of institutes was one hundred and eighty-eight, and the average attendance was about two hundred and fifty. Of the one hundred and eighty-eight institutes held, sixty-five were one day institutes and one hundred and twenty-three were two days.

The apportionment of time to each county is made on the basis of two days of institute to every county having not over one thousand farms; three days to each county having more than one thousand and not over fifteen hundred; afterwards, one day for each fifteen hundred farms or fraction thereof additional. This insures Department aid to each county in proportion to its agricultural interests.

The allotment of money last year was $9.00 per day for local expenses, not including the expenses of the meeting of the local managers on the second Tuesday of June. The State furnished also in every case two lecturers free of expense to the locality, and in many instances three. A large number of posters were distributed to the various county managers for use in advertising, also postal cards upon which an invitation to the institutes was printed, all ready to address to farmers and others interested in agricultural affairs. Many thousand circular letters to prominent farmers were also sent out directly from the Department, calling attention to the institutes to be held in their locality and urging them to attend and take part in the exercises. A letter was also addressed to each county superintendent of public schools asking them to invite the school teachers, school directors, and through them the school children, to the educational session. To this request there was a very cordial and general response, and we were favored with the presence and assistance of the prominent educators of each county, at many of the sessions. The school children also turned out, and were among our most interested and appreciative listeners.

In planning the work for that year the following circular letter was sent out by the Director to all of the local managers, with the request that they comply with the suggestions which it contains.

"In order that the work may be most effective, our efforts should be concentrated upon a few fundamental objects, rather than be scat-

tered over a large area, thus wasting power and accomplishing comparatively little. Much institute work in this and other states has failed to effect the best results, not because the workers were not competent, conscientious and energetic, but because those directing their efforts did not have before them, a well defined and definite set of objects to be attained. It is proposed to attempt to correct this error into which we and others have fallen, by prescribing three topics which are to be discussed in every institute to be held in Pennsylvania this season.

"In every two days' institute the evening session of the first day is to be set apart for the benefit of ladies, and is to be in the interest of 'Country Homes.' This will include all that relates to home life in the country. The constructing of homes, the heating, lighting, ventilating and sanitary arrangements for country homes; the water supply, sewage and plumbing for houses in the country; the cooking of foods, the care of the sick, the care of children, flower gardening, kitchen gardening, house decoration and all that relates, in any way, to comfort, convenience, health and enjoyment in a country home. As many ladies as possible should be put on the programme for this session.

"The afternoon session of the second day is to be devoted to the subject of 'Good Roads.' This is a 'Supervisor's Session,' and as far as may be necessary, all discussions are to be upon the subject of roads and their improvement. The evening session of the second day is to be an 'Educational Session,' and is to be distinctively in the interest of the education of the farmer and his children, and all that concerns their intellectual nature and development. Under this topic can be discussed the course of reading for farmers, the institute, the grange, the alliance and the farmers' club as educators. Also the country district school, the country high school, courses of study for country children, etc. To this all school teachers and school children ought to be invited; also school directors, county superintendents and all who are interested in the education of country people. In the two sessions, institute managers have the option of introducing such topics relating to agriculture as they deem best, but the three sessions, named are prescribed, and no option is given with regard to them. This is done that we may, in all of our institutes, concentrate all of our energies, for at least one season, upon the solution of these most important questions that now interest us as farmers, and affect so deeply the present and future well being and proseperity of ourselves and our children. Another season we can take up some other topics and discuss them thoroughly, and thus get at the best thought of our farmers upon matters vital to agricultural people. Every two day programme, therefore, will contain these three topics, and have them scheduled at the time of day just designated.

"Every one day institute will have the afternoon session devoted to 'Good Roads,' and the evening session to 'Education for Farmers and their Children.' The morning session is left open for the more general topics relating to agriculture. Let us all unite in a determined effort to make these discussions of the greatest value to the interests represented, and thus come to a more perfect understanding, as to what is best to be done, in regard to these serious social questions which confront us. In selecting speakers, therefore, keep in mind the topics prescribed, and secure persons who will be able to give information that will aid us all to a better understanding of the subjects discussed, and form the basis for making up a judgment upon which to act."

The State lecturers were also written to, and requested to prepare themselves for the discussion of the topics prescribed. The effect of this concentration of thought upon these special subjects was very far reaching, and no doubt did much in the way of securing to the State a uniform method of road supervision and control, together with the promise of State aid in road construction, and also awakened a lively interest in the public schools, and materially assisted in preserving intact the State appropriation of $5,500,000 for school purposes, and also did much to open the eyes of country people to the great inequality in the distribution of this fund, and aided in enacting the present law which provides for a more equitable method.

Great interest was also awakened in the improvement of country homes, and in lightening the burdens of those who occupy these homes. The ladies have taken an active and intelligent part in these sessions, and in many cases the meetings were conducted entirely by the ladies. The experiment was therefore quit successful, and in my opinion ought to be continued.

The great weakness of our country people lies in their lack of consolidation of thought upon a given question. When all of the country people agree upon any given subject their desire will be gratified. Their failure lies in their lack of agreement, and the lack of agreement is usually due to a lack of accurate knowledge of the subject and its true bearing upon their industry. A campaign of education is therefore a necessity premilinary to action upon any great public question, and the education ought to be given by disinterested and fair minded teachers, who have made special study of the problems, and are prepared to explain their workings in a clear and practical way, and outside of partisan lines. The institute does this, and by having some leading topics prescribed for every institute held in the State and the time fixed at which a given discussion is to occur, the Department is enabled to advertise these meeting weeks in advance, and secure the interest and attendance of a large number of people who would otherwise have had no knowledge of the intended discussion.

The local managers of the institutes have for the most part been very cordial and efficient in the work. The chairmen of these boards are men of long experience as members of the State Board of Agriculture, and can be relied upon to do all that is possible to make their institutes a success. I wish again to express my appreciation of their hearty and efficient support and faithful work. Too much praise cannot be given them for their long continued service, and for the spirit and enthusiam that they manifested in forwarding this, the greatest educational movement of our time. The local boards of managers have also been earnest and efficient and have cheerfully aided in organizing and carrying on the institutes in their immediate localities. After speakers have been selected, places and dates chosen and all of the preliminary work done, the institute will still be a failure if the local committee do not advertise it and work up an interest in its success. A live, active grange, alliance or farmers' club will insure a successful institute, if one is held in their locality, and much of the success is due to the active and intelligent co-operation of these various organizations. Sometimes local jealousies between different societies have interfered with the best results, but as a rule these, are, for the time, laid aside, and all have united in a harmonous meeting and have made it a success.

Our lecturers also have shown good judgment and marked ability in the work in which they have engaged. Most of them are men and women of exceptional ability, and are specially qualified to give instruction. It is a rare thing for them to fail in creating a good impression in their presentation of the facts that they are trying to impress. Reports are required from these lecturers, and also from the local managers so that glaring errors cannot occur without the matter being noted and information forwarded to the Department. These communications are, of course, confidential, and are solely for the guidance of the director of institutes in the prosecution of the work. Lecturers and managers are therefore requested to use perfect freedom in reporting the defects of preparation or other important matters affecting the efficiency of the institutes, and know that their communications will be treated in a confidential way and with proper respect. They are also specially urged to report all efficient work and offer suggestions for still greater improvement. Local managers and essayists are specially to be encouraged, and every effort be put forth to bring out home talent, being careful to have it work along agricultural lines. The purpose is to develop agriculture, and this is most effectively done by developing the individual. It is impossible to publish all of the papers and essays that are presented, owing to lack of space, accordingly, only some of the best are selected and printed in the annual report.

Public sentiment is now, more than ever, demanding institutes for instruction. Their great value is being more widely appreciated, and

much embarrassment is now experienced, in selecting, from the many applications for institutes, the few places that it is possible to supply. The Legislature at its last session showed the increasing favor of this work, in the estimation of our farming people, by appropriating $12,500 per year for the next two years, an increase of $5,000 per year over the previous appropriation. It is very gratifying to have this appreciation shown in such a substantial way, and it is hoped that the future work will abundantly justify the liberality thus shown.

The farmers' institute movement has been developing very rapidly in the last few years, until now it is in existence and operation in some form in nearly every state in the Union, as well as in the Provinces of Canada. The uniform testimony is that it meets an immediate need on the part of our agricultural people in taking to them the latest scientific explanation of the best methods in agriculture, as demonstrated by actual practice, by the experiment stations, and upon individual farms. Farmers find that they can learn more satisfactorily about their business, from oral teaching and through conversation with specialists upon agricultural topics, than from any other source of information. The institute provides this method of instruction, and is getting down closer each year to the actual needs of agriculture and is therefore interesting and benefitting a larger number than ever before. The chief difficulty in most localities is to secure halls large enough to hold comfortably the people who attend.

A National organization of institute managers was effected in March, 1896, and at a subsequent meeting held October 14, of the same year in Chicago, a constitution and by-laws were formally adopted, and the organization named "The American Association of Farmers' Institute Managers." A third meeting was held in Columbus, Ohio, and whilst comparison of institute work, as conducted in the several states, showed diversity of operation, yet the leading purposes were found to be identical, namely, to carry instruction in agriculture to farmers of the country, and to assist rural people by giving opportunity for interchange of views as to the most successful practice under the conditions that exist in the several communities throughout the land. In all of the states except one or two, the same general system of management prevails; a State institute manager who has general direction of the work, also local committees who look after the details in localities where the institutes are to be held. As I have intimated, in matters of detail there was great diversity, but the leading objects were the same, namely, that the farmers' institute is an educational institution, and ought to be conducted with that idea as the controlling feature in the work. The writer was asked to prepare a paper for the National meeting at Columbus, Ohio, upon "How May the Distinctively Educational Value of Institutes be Promoted." As this is a vital question in this State, and one that needs immediate solution, a portion of that paper is incorporated in this report as giving a possible way out of the difficulty that confronts us.

Whatever the original conception of the farmers' institute was, it is now perfectly clear that it ought to be a school. Not a school for general culture, but a school for the teaching of the principles of practical agriculture. The value of any school is due to two things. First: The facts or information that it gives to the scholars. Second: The awakening or vivifying power that it imparts, which induces or compels the scholar to think.

The farmers' institute is no exception to this rule. It ought to impart valuable information in regard to the farmer's calling in all of its details, and should also be a sort of a revival meeting, stirring up the sluggish or disheartened farmer to new ideas, showing him the possibilities of agriculture when properly pursued, and encouraging and stimulating those who are engaged in it to renewed exertion and to the more intelligent use of the means necessary to success in this occupation.

The amount of time that ought to be allotted in an institute to the information giving work, and the amount to that of revival and the entertainment, depends upon the character of the audience and their previous history and training. If the people live in an old, settled, highly educated and advanced community, the educational or information side ought to predominate and often, perhaps, occupy all of the time. If, on the other hand, the community is new and agriculture backward, the people not so far advanced and the location remote, a more elementary course of instruction must be provided, and a considerable proportion of the time be given to entertainment and encouragement. In other words, a sort of kindergarten method be pursued until the people are prepared for the more strictly educational work. It is the experience of institute workers in about all of the states that the methods and instruction that were suitable ten years ago in the institute work, are no longer satisfactory, but a higher grade of teaching is demanded.

In discussing the information giving side of the institute work, we are met, at the outset, with the question: What ought the institute to teach, and what ought to be the standard of its educational work?

Heretofore, in most of the States, the question of what the institutes shall teach has been left to the various localities to select. As a consequence, there has been no systematic or prescribed course of instruction, but a desultory and fragmentary method somewhat on the restaurant plan of, "order what you wish," and we will try to supply you. So long as the institute work is in the revival stage of its progress, this method, is, perhaps, the only one that can be pursued, but when it reaches the true educational idea, then a more systematic and logical method of education will be a necessity.

Such an ideal cannot, of course, be introduced suddenly, or ever, perhaps, be entirely substituted for the present method, but it is possible, and, in my opinion, will soon become imperative, to gradually

prescribe some topics to be taken up all over the State in every institute that is held, selecting such subjects as are of vital importance.

The abandonment of the haphazard method of instruction and the gradual adoption of a carefully planned and systematic course of study will mark a new and most important era in institute development. What the institute shall teach ought to be limited to the study of subjects bearing directly upon the life and occupation of agricultural people. It is, of course, impossible to take up, in any proper sense, the study of botany, geology, chemistry and kindred subjects. First of all, there is not the time for such a course, and the institute student, as a rule, is beyond the period of life when he can undertake such work as this. The most that can be done is to teach the institute scholar the results of scientific research. To show the application of science and the arts to his industry and acquaint him with the methods by which favorable results are most surely and economically reached. Wherever the farmer has had the advantage of scientific training, his understanding and appreciation of the truths taught will be greatly increased and his ability to use the knowledge conveyed will be greatly enlarged.

But the other question now arises, how far shall such teaching be carried? In other words, what is the limit beyond which it cannot go?

There is no limit beyond which such information may not go. The most thorough, the most scientific, if it be made practical, will be the best, and whenever great underlying principles can be presented, the more valuable and generally useful will the instruction be. Agriculture has abandoned swaddling clothes and the diluted diet of years ago. She is now demanding strong meat, and her future growth and development will be in proportion, as she receives the nourishment that her enlarged life and increased activities require.

She is rapidly leaving superstitious and empirical methods, and is being guided by the exact and reliable revelations of science, and is engaged in making her calling more pleasant as well as more profitable and her rewards sure. The time for guessing is fast disappearing and the day of definite knowledge is at hand. Not long ago men did not know, because they could not know. But now, thanks to modern science and discovery, knowledge has increased and the farmer of to-day can not excuse his ignorance and failure, on the plea that the true principles of procedure are unrevealed. The danger is not that too much knowledge may be given, provided the truth to be imparted be suitably prepared and agreeably and forcibly presented.

The serious problem now is, how shall this knowledge that exists, and which is to aid the rural people in their occupation, best be disseminated, so that those who need it shall receive it in its most useable form?

The farmers' institute has undertaken to do this by means of oral

teaching. By bringing competent men and women before assemblies of agricultural people, and there, face to face, presenting the truths that their study and experience have shown to be adapted to the needs of farmers and to be of practical value in their calling. In the earlier stages of the institute work there was comparatively little difficulty in securing a sufficient number of capable persons for this service. But now, as the requirements of the people have become more exacting, and the standard of teaching more advanced, the greatest difficulty that the institute director meets is to find teachers who are competent to properly and profitably instruct those who are seeking knowledge. This difficulty has increased within the last few years, until now it is a serious question to know where suitable lecturers can be found. As the work advances this difficulty will continue to increase, and unless some means are found for supplying this increasing demand, we will soon be unable to carry on the work as its importance and character require.

A school pre-supposes teachers. The better the teacher the better the school, and no educational institution can rise above the level of its instructors. If, therefore, the educational value of our institute work is to be increased, we must secure the services of high grade instructors, and cease to employ those who are incompetent or inapt to teach.

How are such men to be secured? Men and women competent for this service are not unemployed. Their qualifications have made them valuable, and such people are in demand at remunerative salaries in the various industries and educational institutions of the country.

If institute directors wish their services, they can only secure them during a vacation period, or by special contract made subject to the possibilties of being called away by the regular duties of their occupation. Comparatively few have made institute work a profession and very few will do so unless the conditions that now prevail are materially changed.

Under our present system, the institute lecture season continues for about three or four months in every year, and the men who are engaged as lecturers have no assurance of any employment after the institute season has expired. Very few are situated so as to drop their present work and take up the lecture course for the limited period through which it lasts.

As I have stated, the demand for high grade instruction is becoming greater each year, and yet no man can afford to devote himself to special preparation for this work for the short period for which his services are, at present, required. We are in the position of having an ever increasing demand, and a stationary or perhaps diminishing supply; a situation fatal to further progress.

The overcoming of this difficulty may necessitate an entire change in our methods of conducting institute work. We will be under the

necessity of giving employment to our best men the entire year, so as to make institute teaching a distinct profession, and thus make it worth the time and effort necessary for competent men and women to prepare themselves for it and make it a life pursuit.

Can this be done, and if it is possible, what is the plan, and are we ready to undertake to carry it into effect?

Let the institute director sub-divide the State into institute districts, each composed of several counties, and appoint one or more lecturers to have charge of each district. Let these districts be again subdivided into comparatively small divisions, either township or school districts as may be thought best, and establish a school in each of these sub-districts whose members would meet at least once each month to hear a lecture on some general agricultural topic, the lecturer being the teacher who had been appointed over the larger district, and whose duty it should be to visit each school once each month to deliver a lecture and to advise in regard to any other matters relating to agriculture that might be of interest to the locality. They should also, when opportunity offers, hold meetings in the fields, orchards, gardens and barns of the farmers, and there, in an informal and practical way, call attention to new, improved, and more economical methods; point out defects in practice, suggest remedies, and thus, in the presence of the conditions as they actually exist in that community, assist the farmers in meeting and surmounting their difficulties.

Let this system continue for about eight or nine months of the year, from spring until winter, and, when winter comes, advertise for an institute for each county to last for one week, at which the whole corps of lecturers should be present, taking turns as instructors and exchanging as soon as one instructor has finished with another who will take up a different topic. Several institutes could be in operation at the same time in different counties, thus keeping the entire force engaged, the entire programme to be previously arranged so as to comprise a thorough and systematic course of instruction for the entire State. The lecturer in charge of a district ought to first visit all localities where schools are proposed to be located and secure the names and consent of a number of farmers agreeing to attend at the places, and on the dates fixed for its meetings, and to supply a suitable building in which to meet, and see that it is in proper condition for use.

Such a lecturer could be provided with suitable apparatus for illustration, and when he has finished the course of lectures prescribed, he would be replaced by another teacher with a different set of subjects.

Such a system would have several advantages. It would furnish occupation during the entire year for the institute force and, consequently, would attract our best men to this service.

It would provide systematic instruction to our farming people, a necessity in every course of instruction that is to be of value and is to continue.

It would awaken an interest in agriculture in every community, and contribute to the success of the general county institute held in the winter.

It would disseminate information of the most valuable kind and be an opportunity for interesting the young country people in agriculture, and be a means of influencing them to take advantage of the higher institutions of learning established to fit young people for agricultural pursuits.

It would prove an efficient agent for the establishment of reading circles among our farmers, and bring to their attention the latest and best literature upon the subjects related to their calling.

It would transform the farmers' institute into a complete and well-equipped educational institution for the education of the farmers, and bring to their doors the latest and best methods of agricultural practice known.

The value of the agricultural institute is dependent upon the efficiency of the teachers employed to give instruction, and the future progress of the institute work will, therefore, be in exact proportion as these teachers increase in knowledge of the scientific and practical facts upon which successful agriculture is founded.

The important problem, therefore, for the future institute director to solve is to discover such a plan as will insure a sufficient number of competent teachers who will be willing to engage in this work, and be at hand for service whenever and wherever their presence is required.

Respectfully,

JOHN HAMILTON,

Deputy Secretary and Director of Institutes.

REPORT OF THE STATE ZOOLOGIST.

HARRISBURG, PA., January 1, 1898.

HON. THOMAS J. EDGE, SECRETARY OF AGRICULTURE:

Dear Sir: I have the honor to submit herewith the following report of work done during the present year, together with a brief abstract of work outlined for 1898. I have also included a short resume of miscellaneous papers on a number of zoological topics, several of which are or will be ready for the annual report of the Department.

These miscellaneous papers relate to subjects which are of especial interest to the citizens of this Commonwealth. Containing, as some do, a large amount of matter the result of careful field observations, they will, it is believed, be of especial interest and profit to those who are engaged in agricultural pursuits. If, in your judgment, these miscellaneous papers and special reports will exceed the space assigned in your annual report for the fiscal year, I would respectfully suggest that they be printed in bulletin form at as early a date as may be practicable.

The residents of this Commonwealth can obtain from the division over which I have the honor to preside, much useful information, if the matter now prepared or nearing completion is printed in an attractive form and given wide circulation, such as it should have.

These several miscellaneous papers, together with others in course of preparation, embracing a large number of subjects, are discussed in a popular way, and they will be acceptable, it is believed, alike to farmers, horticulturists, poulterers, natural history students and sportsmen.

The work of the division has, it is needless to say, been seriously hampered by the disastrous fire of February last, which consumed my private library of several hundred volumes, with note books containing data collected in my field work during the past twenty years. I also lost in the fire several thousand replies, which had been kindly sent by farmers, fruit growers and naturalists in Pennsylvania for the use of your Department, to circulars in relation to birds, insects and mammals. The loss of this valuable material is one which is almost irreparable. I have made several visits to Washington, D. C., and through the kindness of the heads of the several divisions of the agricultural and other departments have been enabled to replace a number of the scientific books, reports, bulletins and papers which were devoured by the flames. I have also spent considerable time at the

Smithsonian Institution and National Museum, Washington, D. C., the Philadelphia Academy of Natural Sciences and the Philadelphia Wagner Free Institute of Sciences, obtaining necessary data for the work of this division. This interruption in the work of my branch of your Department has prevented me from engaging in certain lines of active field work which had been determined upon last year when my annual report was submitted to you.

Early in January, last, I was detailed by you, at the suggestion of His Excellency, Governor D. H. Hastings, to assist the members of the Board of Game Commissioners in their work. In consequence of radical changes made in the game laws by the last Legislature, a very widespread interest has developed in all parts of the Commonwealth concerning the said laws, and a very universal interest is manifested by all classes of our State's citizens as to the importance and necessity of giving better protection to game, (birds and mammals).

To date I have answered fully two thousand letters on matters relative to game laws, game protection and other business of the Board of Game Commissioners. Several thousand postal cards and circulars giving information which the people wanted concerning laws relating to game, fish and wild birds and other matters, have been issued and distributed from this office.

I have sent to subordinate granges, Farmers' Alliance clubs, sportsmen's associations and individual farmers whose names were sent to this office by members of the Senate and House of Representatives, seven or eight thousand circulars making inquiries concerning game, fish and the economic relations of a number of our common birds and mammals, about which so many wrong impressions appear to exist in the popular mind. A vast amount of particularly valuable material has been received in reply to these circulars, and much of this matter will soon be available for publication in such form as you may deem proper to direct.

During the year drawing to a close, 357 specimens (39 species) of insect life have been received from farmers and horticulturists throughout the State. All have been identified and brief descriptions, with, in many cases, remedies for their destruction, have been mailed to persons who desired such information; 78 specimens (45 species) of birds—chiefly sparrows and warblers—have been received and identified. The common and technical names of these birds were returned, with short accounts of their food habits, to the farmers, sportsmen and ornithological students who requested such explanations. Eight specimens of mammals also reached this office and, as with the birds and insects, the desired information relating to the same was promptly returned to the senders.

Last year, when my preliminary report was sent to you, I had in manuscript eight or nine bulletins relating to different topics of especial interest to farmers, pomologists, naturalists and sportsmen,

ready for publication. With two or three exceptions these papers which had been prepared with much labor, both in field and office, and at considerable money expense, were totally or partly destroyed in the fire previously referred to. I have, however, had time to rewrite most of this matter, and will, at an early date, be able to give them to the public in bulletin form. Fortunately, one of the most valuable reports of this series, a paper, entitled "The Economic Status of the Mole Family in Pennsylvania," by Mr. Harry Wilson, an able and bright young naturalist of Chester county, was preserved in its entirety. This special report, prepared at your instance by Mr. Wilson, under the direction of the head of the Division of Zoology, is a most exhaustive and valuable one, and as it deals with a subject of especial interest to the agriculturist, it should not fail to meet with a cordial reception from farmers, many of whom are unjustly prejudiced against the moles, which are so often mistaken for field mice.

Assisted, as I have been most generously, by my good-hearted and brilliant colleague, Dr. J. T. Rothrock, Forestry Commissioner, I have, during the past few months, collected from numerous lumbermen and other sources a large amount of particularly interesting and valuable data, showing the character and extent of losses to many species of wild birds and mammals through devastating forest fires. This important and instructive matter will, with your permission, be prepared and published with other papers as a joint bulletin or special report by Dr. Rothrock and myself.

After a great deal of trouble I have collected (thanks to a good act of Assembly prepared by our Forestry Commissioner) "bounty and scalp" statistics from nearly all the counties of the State. These records, when published, will show clearly the folly of such wasteful and unwise legislation which leads frequently to the killing of many of the most valuable feathered and furred friends which the tiller of the soil has, and which devour the insect pests that attack his crops by night and day.

For several years past the writer has labored untiringly to prevent the passage of unjust scalp acts. By our united efforts, with the valuable assistance given by a number of the members of the State Board of Agriculture, we were enabled to bring about, after a very spirited contest, the repeal of some unwise and vicious provisions in the odious bounty act of 1885, which cost the counties (other than Philadelphia and Allegheny) fully $150,000 (estimated) in less than two years. It has been clearly shown that a very large part of this money was expended for the killing of birds and other animals which preyed almost exclusively on insidious insect foes and voracious mice that yearly destroyed probably fully ten per cent. of the cultivated crops.

Birds and certain other kinds of insect-destroying animal life are the agencies designed by Divine power to keep in check such pests

when they invade man's fruitful possessions. If, through unjust prejudice, brought about by ignorance and greed, we disturb nature's balance, but one result is the logical sequence, namely, hardship and great money loss to farmers and horticulturists, forsooth, a very important class of our State's citizens. Indeed, they are foremost among the people for whose succor your branch of the State administration was created.

From replies to circulars, by correspondence and through other avenues, we find, I regret to say, a strong sentiment in favor of perpetuating bounty laws, which in some form or other have existed since the days of our Puritan ancestors.

The payment of liberal premiums is favored by many of our citizens for numerous kinds of birds and animals which they appear to believe do little else but catch poultry, game and fish, and when tiring of such food, they, or at least some, visit the farmer's premises to devour the young of sheep, pigs or horned cattle.

Strange as it may seem, many of the birds and other animals for which bounties are urged are, contrary to prevalent impression, species which subsist mainly on detrimental forms of animal life, such as May beetles, white grubs, cut worms, army worms, grasshoppers, mice, etc.

Many sportsmen and some fish culturists favor a liberal bounty for the tufted head of the kingfisher because he catches trout, bass and different kinds of small-sized fish. The osprey, or fish hawk, the great blue heron, the night heron and the familiar fly-up-the-creek or green heron, which is also known by other common names much more expressive than elegant, are condemned in strong terms and their extermination advocated.

Several countries on the continent have tried the experiment of paying bounties for fish-destroying birds and quadrupeds with results that have proven most expensive and othewise unsatisfactory.

It is hoped that this Commonwealth's lawmakers and governors will never sanction measures which encourage the destruction of the lively and noisy kingfisher and the little remnant of the heron family which frequent our streams, lakes and ponds.

The sparrow, introduced from Europe, like a good many other bad things which have crossed the ocean to plague honest and industrious American citizens, is another one which is, very properly, in bad repute.

Because this bird commonly, but incorrectly, called English sparrow, does a great amount of damage, the cry "place a small bounty on the sparrow," is heard. If this species could be eradicated by such an expenditure of public funds, it would be money well spent.

However, a premium for the head of the worthless English sparrow would not cause his extermination, but it would, through ignorance

and fraudulent practices, I have no doubt, bring about speedily a large outlay of money and also the destruction of perhaps not less than a hundred kinds of small wild birds, which designedly or through ignorance, would be slain and sold for English sparrows.

The State Game Commission.

The members of the Board of Game Commissioners, without pecuniary aid, other than that which they raised by voluntary contribution, have in the short period of their official life done most efficient work. The famous Harris game bill, which is one of the best laws for the protection of game and wild song birds in the United States, was framed by these gentlemen who spent liberally of their private funds and devoted much valuable time in its preparation.

This measure is one that is not of interest alone to lovers of field sports; we find certain of its important and restricting clauses will, ere many years, if properly enforced, result in untold benefits to farmers and fruit growers, as it gives a much needed protecting hand to the sorely persecuted insectivorous birds. Thus it can be seen that critics who have complained about "too much attention given to game legislation, etc.," had little foundation, in fact, for their utterances, prompted doubtless by jealousy and pique.

The Board of Game Commissioners have accumulated, notwithstanding the serious losses it incurred by the February fire, a considerable mass of interesting facts relating to various matters, which when published will be of great interest and benefit to the citizens of Pennsylvania.

The good effects of the game bill, approved June 4, 1897, are already manifest. Reports from almost every county, show that the efficient corps of game protectors and their assistant deputies are doing effective work. The efforts of these gentlemen, whose duties are to see that the provisions of the law are strictly enforced, are, fortunately, made in such a manner as to meet with earnest popular approval.

For some years past this Commonwealth has been plagued with individuals who made a regular business of killing, in and out of season, various species of game birds and mammals for the market. Again another class of individuals wandered about the rural districts in different parts of the State to slaughter the innocent, bright-plumaged song and insectivorous wild birds for the few paltry dollars their skins were worth to the millinery trade.

The Game Commissioners are determined that such evil practices shall be at once abandoned. They have given strict instructions to their chief game warden and his subordinates to prosecute without fear or favor professional market hunters and taxidermists who may continue to pursue their nefarious and illegal occupations. No cer-

tificates to collect birds and game mammals for scientific purposes as required by the act of 1897, will be granted by the Commissioners if there is any reason to believe the persons applying for the same will use this power in any improper way.

Special Investigations.

Last summer I was authorized by the Deputy Secretary of Agriculture, Professor John Hamilton, to institute, as time would allow, special investigations as follows:

1. Field Mice, and Best Methods for their Destruction.
2. Grasshoppers, and How to Get Rid of Them.
3. Lice and Other Insects which Annoy Cattle.
4. The English Sparrow and its Relation to Agricultural Interests.
5. Currant, Grape, and Gooseberry Destroying Insects.
6. The Wheat Weevil and Wheat Midge.
7. White Grubs.

Investigations in these several diverse branches of zoology have been begun, and considerable instructive and valuable matter relating thereto is on file.

Three thousand circulars relating to the English sparrow, other common birds and animals, have been distributed to citizens throughout the State, and a large quantity of instructive and valuable data has been received from farmers, fruit-raisers, poulterers and naturalists, from all parts of the Commonwealth. The material collected from correspondence in relation to the English sparrow is especially replete with interest, and this when published with the detailed results of several hundred stomach-examinations made by the zoologist and his assistants, of these little naturalized feathered pests, taken at all seasons of the year, will demonstrate exclusively that this passerine bird is a curse to any civilized country where it becomes naturalized. Outward observation and post-mortem dissections demonstrate beyond all doubt that the sparrow destroys cereals, ripe fruits, buds and blossoms of shade and fruit trees. The tender growth of the grape and other vines are choice morsels for him; he delights to devour, under the eyes of the good house-wife, the early garden produce, and when he tires of succulent vegetable-food, his depraved taste leads him to kill the young or eat the eggs of valuable insect-destroying birds: such as wrens, bluebirds, flycatchers, orioles, etc., which love to make their homes about human habitations.

Some Work For 1898.

The work, in part, which I hope to do in the coming year will be:

1st. The preparation so as to be ready for publication, as bulletins or special reports, of the miscellaneous data which has been collected

and is on file in this office, which relates to insects, and remedies for their destruction; birds and mammals, i. e. the common species and their relation to the farmer and fruit-growers; likewise the bounty records with a large mass of matter showing the enormous annual loss sustained by poultry raisers and farmers through the visits of predatory birds and mammals.

2d. I have also nearly ready for publication in such manner as you shall deem most suitable, a report descriptive of some "Rare Summer Birds, and Certain Favorite Hunting and Fishing Resorts in Pennsylvania and Neighboring States."

3d. Knowing as I do, that it is your wish to have new and original work done under your direction, I have planned a series of systematic field investigations for the year and will, with competent assistants, devote particular attention to the study of certain common insects and by careful experiments endeavor to ascertain better means, than are at present known to economic entomological science, for successfully combating these insidious foes, which annually ruin our cultivated crops to the extent of certainly not less than $2,000,000.

4th. The energetic work of my efficient colleague, Dr. J. T. Rothrock, has aroused public sentiment to the importance; yes, the imperative necessity of protecting and perpetuating forest trees. To do this successfully our citizens should have a clearer understanding of the crawling and winged insect hosts which infest many species of the forest and shade trees. The insect enemies of trees and shrubbery are legion. It is my intention to give attention to many of this large class of tree destroyers, and also the birds and other natural agencies, which the wise Creator placed in our midst to keep in check these voracious pests which as Dr. Coues remarks, are "singly insignificant, but collectively a scourge."

Miscellaneous Papers.

No. 1. Ravens, Crows, Jays and Shrikes. This paper deals quite fully with several birds, about which inquiries are almost daily made at this Department. The relations which these birds have to man is plainly shown by careful investigations conducted in both field and laboratory. The paper is written from an impartial standpoint and explains the bad habits as well as the good traits in the lives of these well-known birds.

No. 2. Skunks and Their Economic Value. Two forms of these exceedingly prolific and badly abused animals, which prowl about in twilight and dark to prey on insects, destructive larvae and field mice, occur in Pennsylvania. Skunks are probably the most valuable of all our mammals, so far as the interests of agriculture are concerned, notwithstanding the fact that they will sometimes devour the eggs of a

clucking old hen, or pillage nests of wild birds which breed on or within reach of the ground. The paper contains many interesting and valuable contributions from practical farmers, poultry raisers and sportsmen. It explains the habits of these animals so zealously protected by the hop-growers of the Empire State, where they consume immense numbers of "white grubs" which have recently caused much loss to crops in Pennsylvania.

No. 3. Some Household Pests and How to Get Rid of Them. This paper has been prepared in consequence of repeated requests which have come to this office for such literature. The paper is one which will be very acceptable to the good housewife, as it deals in a brief way with some very troublesome insect pests which so often defy her most painstaking efforts to eradicate.

No. 4. Miscellaneous Natural History Notes. This far reaching and somewhat indefinite title is the caption of a paper which treats of many facts of interest and value on a number of species of birds, mammals and insects. The data it contains will be appreciated by zoological students, and at the same time be instructive to farmers and horticulturists.

No. 5. Pests. We have in the ample field of nature certain species of birds and mammals, as well as divers forms of insect life, which annually do great damage to man's interests. This paper entitled "Pests" relates to some common species which, in recent years, have attracted considerable attention because their habits militate against mankind.

No. 6. Some Interesting Facts Concerning Game. This paper has been prepared to meet a very large demand which is made by educational people, school children and lovers of field sports for such matter.

In consequence of the steadily increasing popular interest in zoological science and outing excursions, which latter diversions are engaged in by all classes, it has been deemed advisable to incorporate in this paper data which will show where the sportsman, angler, student and tourist can go to find the object of his desire, whether he goes in quest of game, fish, knowledge, recreation or health.

All of which is respectfully submitted.

B. H. WARREN,
State Zoologist.

REPORT OF THE COMMISSIONER OF FORESTRY.

HARRISBURG, PA., January 1, 1898.

HON. THOS. J. EDGE, SECRETARY OF AGRICULTURE :

Dear Sir: For a division which has been in existence but two years, operating in a field practically new to our people, with our plans to formulate, and our methods of work to develop, we feel that a most gratifying start has been made.

It was something to convince a people, who had grown up in sight of forests supposed to be inexhaustible, that they would do well to consider the economical methods of lumbering which are practiced in regions where timber is scare, and to provide by wise legal enactments for a restoration of the forest wealth upon which so much of our past prosperity has depended. We can hardly yet realize the full import of the change in public sentiment which has come about so swiftly but so quietly in this State. It is fair to add the strength of the forestry movement in Pennsylvania is a surprise to those in other states who are working with the same object in view.

The whole work here has been done along educational lines. That so much has been accomplished is simply evidence that our people, through their representatives, may be trusted to act wisely upon any question which has been fully stated and fairly placed before them.

Some of the work contemplated by the creation of this division has involved changes in legislation which a few years ago would have been considered as radical, yet the public has already placed the seal of its approval upon them. For example, it has been an established policy of the State, from the earliest period of its history, to dispose of its land cheaply enough to induce settlers to occupy it all as speedily as possible. There was wisdom in this in former years. But we have clearly outgrown the conditions then existing, and the necessity for a change in policy has become apparent. It is now a cause of regret that the need for a change was not discovered before the State had disposed of practically all of its lands. It is now recognized that the good of the largest number requires that a certain portion of the soil should remain as public property, to be managed for the public, in order that the natural laws upon which the prosperous perpetuity of the State depends be not violated, and the very surface of the soil, out of which so much of the wealth and all of the food comes, may be preserved in productive condition.

It was once considered the very essence of equity that all private real property should bear its proportion of taxation, and upon this idea those who prepared the last Constitution of the Commonwealth acted. It now appears that we were leading many of our best citizens by the too rigid application of a sound general principle, to despoil the State, in self-protection. It was the result of a better insight into the relations of the forests to the public that brought a rebate of taxes upon the growing farm timber, which returns to the community at large a benefit for every day that it is allowed to stand. This comes as a direct relief to the depressed agricultural industries of the State.

Just here another principle may claim brief attention. The care which a savage extends to the sick of his own immediate band, civilization has developed into a right on the part of an afflicted citizen to demand care when he is unable to "do for himself." The outgrowth of this idea is seen in every hospital for which the Commonwealth provides. But even this will fail to meet calls which the near future may press upon us. Just as the most rational medical practice is preventive, rather than curative of disease, so the broadest statesmanship will diminish the cost of curing disease, by preventing it, whenever a legitimate function of government can be brought to bear upon the case. Instead of so many hospitals we may have some sanitariums located among the birch and balsam forests. This is neither sentiment nor fancy. It is an event of the next few years. It will be entered upon because of the cold business fact that it is the cheapest thing to do, and because it will destroy a large proportion of invalidism by preventing it, and will give a self-supporting capacity to those who otherwise would have become perpetual charges upon the community. The forest reservations which have been authorized by act of the Legislature will have a large share in the natural development of this idea. The bill creating them was introduced at the request of the Pennsylvania Forestry Association. It should be stated here that the Forestry Division of the Department of Agriculture rendered all proper assistance in making its passage possible.

Then, too, we should call attention here to the change in public sentiment in regard to land sold for taxes. It is but a few years since the idea was broached that the State should become the possessor of them. The favor it met with was but scant. During the past session of the Legislature a bill providing for this was introduced as one of the measures suggested by the Division of Forestry, endorsed by the Department of Agriculture and desired by His Excellency, Governor Hastings. It passed by a practically unanimous vote. No law enacted during the session has been more heartily and universally commended over the State.

This bill, however, marks another stage in our passage to a more rational estimate of the relations of the forests to the community at

large. Becoming State property, such land would no longer be subject to taxation. In reality this is but little hardship to the counties in which it lies because as a matter of fact it now yields little or no revenue from taxes. Under the old law it must have continued to yield less with each successive year, while at the same time it would have become constantly poorer, and have led to a serious derangement of the water flow and water utilization, which would have wrought vast injury to the farm lands below, by freshets on the one hand, and a deficient water supply in dry seasons on the other.

Averting these disasters will be a public benefit which will not be confined to the counties themselves but will extend to the manufacturing and agricultural interests of the regions adjacent along the lower courses of the streams. *The increase of the forest areas, which it is safe to expect under State control, will also tend to lessen the rapidity of evaporation from the cultivated areas, and thus to a certain extent will protect the maturing crops in the season when moisture is most required. With a reasonable prospect of such advantage to the community at large, we may anticipate that any loss to the counties will be more than made good, and that means will be discovered of an equitable relief to the counties for any hardship which might be brought upon them.

There are counties in this State which have hitherto placed so high a tax upon some of their most valuable timber lands, and at the same time afforded so little protection to them against fire, that the owners have been driven to cut the timber, and thus to render the lands so valueless that they were surrenderd (by failure to pay taxes) to the counties. Thus, by one act, these counties deprived themselves of both timber and taxes. It is hardly necessary to point out that this led to a direct loss to the county in which it was done. It was a wrong to the land owner and to the community, and especially to those who are to follow.

Under conditions hitherto existing, forest restoration, on any large scale, was out of the question. The annual fires, with a merciless punctuality, swept over the lands which had been cleared by lumbering operations, until both the young growth and, often, the soil itself were destroyed. In many cases extensive bodies of mature, valuable timber were killed. We had tolerated this until we ceased to consider it a crime to burn a forest, and had come to regard it as inevitable. We had lost sight of the fact that very often such conflagrations were deliberately started by vagrant, irresponsible persons, on ground to which they had no claim, for no other reasons than to increase the yield of berries in subsequent years. Sometimes it was done from malice, or at other times the fires arose from carelessness on

*See page 152 of Paper by Mr. Geo. S. Rafter, C. E., published in Vol. XII. Proceedings of the American Forestry Association.

the part of hunters. It should be stated here that the opening of the hunting season is usually marked by an increase in the number of these fires. In some regions they occur most frequently on Sunday, when persons who are worse than thoughtless are abroad in the woods. Comment on such a condition of affairs is unnecessary. It is enough to say that it was not only a disgrace to our civilization, but that it indicated a neglect on the part of the State to accord to the owner of such lands the protection for which taxes were paid.

It is in vain to assert that to have paid for the suppression of these fires would have led to their creation by evil disposed people who desired employment. The obvious duty of a government is to ferret out and punish such offenders, and to protect the law abiding citizen at all hazards. It is for this that the government exists, and failing to do this it neglects its first duty.

The earliest distinct, practical step toward suppression of such crimes was taken when the old act of June 2, 1870, was amended and a penalty clause attached which will compel county commissioners to make an effort to bring such offenders to justice, the State in consideration of the general benefits to be derived bearing a portion of the expenses.

The next practical measure, also originated and sanctioned by the Department of Agriculture, was placing the duty of suppressing forest fires upon constables within whose districts they occurred. It also provides a penalty for failure to perform this duty. Having the right to summon a posse to their aid, there can be no excuse for failure to greatly reduce the losses which the State has hitherto suffered from these annual fires. It should be added and emphasized that no man is required by this act to work without reasonable compensation, and that the Commonwealth assumes a fair share of the pecuniary responsibility.

It is not supposed that there will be no forest fires in the future. Some will inevitably arise. We may, however, look for a decrease in their number and for a more prompt suppression of them when they do occur. Neither do we anticipate that the best effects of this law will follow its earliest operation. It is true, and unfortunate that it is true, that a certain number of convictions must follow before the ignorant or malicious can be brought to recognize the existence of any law. This law will be salutary just in proportion as it is rigidly enforced. An act essentially similar has been in operation in the State of New York. It is worth while to quote for a second time from the report of that Commonwealth that "ten years' experience in the matter has demonstrated that the present law relating to the protection of our woodlands from fire is a practical one. We have reason to believe that the widespread and disastrous fires which threatened the existence of our forests at one time will not recur."

An additional safeguard now exists by the passage of the act which authorizes peace officers to make summary arrest "on view," without a warrant having been previously obtained, of those who may be reasonably suspected of violating the laws for the protection of forest property. This was rendered necessary by the fact that in the woodland counties where such offenses are more frequent and most serious, that the formality of obtaining a warrant usually allowed the escape of the offender. Such a law has been in operation in Canada and it is believed with good results.

In certain of our counties it is still the custom to burn over ground which has been recently cleared to put it in condition to obtain a crop of grass. This "burning of the fallows," as it is called, has often been done without proper, or indeed any, precaution being taken to prevent its spread. Some of our most disastrous forest fires have been so created. One can readily see that this condition of affairs is a survival from earlier days, when each settler who opened up a home in the heart of the woods was a "law unto himself." As population increases, and as neighbors approach him, the good of all parties requires certain restraints. In conversation with those who have been accustomed to burn their fallows, it was stated in so many words that it was each man's "business to look out for himself." It was not considered the fault of the man who created the fire if it invaded the property of another, but was regarded as neglect in the second party if he allowed it to do so.

One may readily see that the prevalence of such an idea may work untold harm. It compels any citizen to live in what, at best, might be termed an "armed neutrality" with his neighbor. It opens an avenue for malice to wreak itself upon others and is in every way unsuited to the age in which we live. Some states have legislated against it by requiring such work to be done under official supervision, or at least only at proper times and with official permission. It is supposed by many of our citizens that there is no law to prevent one from creating a fire upon his own property when he sees fit, at any risk to that of his neighbor. If brought into court it would probably be discovered that this is an error, and that the legal responsibility can be placed where it belongs. The pleasantest aspect of this special problem is that it is fast working its own solution, and that we may hope accidents from this cause will constantly become rarer.

In connection with forest fires another question may any day be started. For example, "back firing" has long been resorted to as a most efficient method of heading off a previously existing forest fire. That it is open to grave abuse no one can doubt. To illustrate: A fire exists on the land of A. The land of B lies between that of A and C. In order to protect himself C may start a fire along the boundary between B and himself. A change in the wind may occur, and the

fire started designedly by C may burn over the whole property of B. The point is that we have hitherto been using a good remedy recklessly, and legal complications may at any time grow out of it. I am not at present prepared to suggest a remedy.

One reason why the abuses alluded to have been allowed to go so long unchecked is because their serious character was not recognized as fully as now. It was supposed to concern only the land owner. It is clear that there has been a marked change in public sentiment. It is equally clear that there has been a cause for this change. It is probable that the educational influences of your Department, have had some influence in effecting it.

But these laws have a far-reaching, secondary influence which has not yet been alluded to. It is more than probable when prompt, systematic suppression of forest fires comes to be the rule, and the citizens are called upon to do the work, that attention will be directed to the enormity of the crime in a way which has never yet been done, and the men who cause them will come to be regarded as public enemies and culprits. Once public sentiment settles down to this conviction, we may confidently hope for a reformation.

This is the proper place to call attention to a hitherto unconsidered relation of some of the counties to the lands which they now hold because of failure on the part of the owners to pay the taxes upon them. Thus far, they have simply been allowed to go without care or attention. It was a natural consequence that such areas should constantly deteriorate. They were swept over by fires, and browsed upon by cattle, until all of the natural tendency to a fresh growth of timber was practically destroyed. Belonging to the county they were everyone's in the largest sense of the word, and they suffered accordingly. Any squatter or timber thief could do his worst with them almost without "let or hindrance." The time must soon come when the question will arise whether they should not be cared for by the county, in the hopes of a remunerative return.

There are towns in Germany which have for years been practically exempt from taxation because of revenue received from forest lands so managed. It is as least fair to assume when these lands come finally into the hands of the county, that timber thieves, browsing cattle and destructive fires will be kept off. After a few wholesome convictions of law breakers it is more than likely that what timber remains and what comes as sprouts from stumps would, in a few years, show such a marked increase in value as to justify the small cost of such protection.

It is proper in this connection to correct an error which is common over the State. It is generally supposed that forestry begins in tree planting. This is not the case. Forestry begins with properly conducted lumbering operations. Planting is, of all methods of forest

restoration, the most expensive, and is not likely to be resorted to extensively in this country for years to come. Indeed, there is small reason why it should be. With us the first step toward forest restoration, after suppression of fires, is to see that in lumbering, enough of seed trees are allowed to remain to restock the ground. It is not true entirely, or even to any great extent, that the soil refuses to reproduce a crop of the same kind of trees as those which have been cut off. The fact is, it seldom gets the chance to do so, because seed trees are not often left. There is no more reason to expect a perpetual succession of white pine on the same soil, without seed, than there is to look for a perpetual succession of corn on the same field without seed.

There may be a slight advantage given to some fresh kind of tree because of the long previous growth of another kind, but this advantage is hardly marked enough to interfere with the desired crop if an abundant supply of seed is furnished. There are numberless instances over the State in which the abundant second growth of the same species of tree can now be seen. Of course this statement needs the modification which follows. When the physical conditions which once existed, and favored a given species of tree, have been changed by its removal, then some other species may have an advantage. For example, young hemlocks and white pines are extremely sensitive to an intense heat of the sun, and often wilt down under it and die. In the absence of shade a chestnut growth might succeed where the pines or hemlocks would die. But it must be remembered that when our forests are cleared a fire promptly runs through the "slashings," and destroys the undergrowth and the moisture-retaining bed of leaves, which othewise would have protected these young pines and hemlocks. Our own lack of foresight has given an unnatural advantage to the chestnuts, oaks, etc. On the other hand I can now show northern, shady exposures where the spontaneous growth of white pine and hemlock is surprising. These are all questions for "up to date" county officials to consider.

It may be well to give some facts showing that forests can be made a source of revenue. These quoted are from the official reports of Germany, and may be wholly relied upon. From the Dukedom of Oldenburg we have, for the financial years from 1886-7 to 1895-6, as follows:

Year.	Total income.	Total expenses.	Annual net profit.
1886-7,	$41,234	$26,450	$14,784
1887-8,	39,875	27,661	12,214
1888-9,	40,913	26,724	14,189
1889-90,	43,578	26,120	17,458
1890-1,	45,148	27,485	17,663
1891-2,	44,433	27,814	16,619
1892-3,	42,817	27,410	15,407
1893-4,	66,976	31,254	35,722
1894-5,	44,116	30,670	13,446
1895-6,	44,838	30,743	14,096

Or, in other words, the total income from 1886 to 1896 was $453,928; total expenses, $282,331; total net profit was $171,597.00.

The domain forests of the Dukedom of Saxony-Gotha, in the financial year from July 1, 1895, to July 1, 1896, gave the following result:

Total income,	$328,115 00
Total cost of maintenance and administration,	94,469 00
Net annual profit,	$233,646 00
Net annual profit per acre,	3 25

The domain forests of the grand dukedom of Saxony for the financial year 1894 yielded as follows:

Total income,	$224,608 00
Total cost,	165,907 00
Net profit,	$58,701 00
Net profit for the year, per acre,	2 03

A summary of the forest operations of the dukedom of Saxony-Meiningen for the year 1895 shows that 107,085 acres yielded as follows:

Total income,	$445,585 00
Total cost of maintenance and administration,	176,572 00
Total net revenue,	$269,013 00
Total net annual revenue per acre,	2 50

The forest estate of the grand dukedom of Mecklenburg Schwerin contains 268,784 acres. The statement of its operations for the financial year of 1894-5 was as follows:

Total income,	$1,075,119 00
Total cost of maintenance and administration,	314,893 00
Total net profit,	$760,226 00
Total net annual profit per acre,	3 10

In the royal Saxon state forests there are 421,164 acres. The year 1894 shows the following statement:

Total income,	$2,360,489 00
Total cost of maintenance and administration,	856,132 00
Total net profit,	$1,504,357 00
Total net annual profit per acre,	3 57

In so far as these statistics bear upon our forests and their possible production, the natural answer to them would be, that under existing conditions we can hope for no such returns. This is entirely true if we consider immediate returns only. But the reply would require very considerable modification if we consider future possibilities. The facts are that we are nearer a shortage of timber at this moment than we suppose and that it will require years before we have changed our extravagant habits in the use of lumber. Low prices now prevailing are due to two causes—i. e., cheap "cut-rate," transportation on the one hand, and the glut of hemlock caused by cutting these trees to obtain bark on the other.

This condition cannot endure, and when the change comes, as come it will, we may expect much higher prices to rule the lumber market. Then, too, no one can predict the size of the possible demand for pulp wood. Its increase in the last few years has been fabulous. It is an open secret that the pulp manufacturers are at this moment concerned over the source of their future supply.

A Plain Statement of an Important Problem.

The following item comes from the Pittsburg Post, of October 15, 1897:

"Extreme quietness still prevails along the wharves. Up-river packets are enjoying a fair trade, but there is little or nothing done

among the tow boats. The river has not been so low in many years, and the outlook for a rise this month is not promising. Two days' steady rain would be necessary to bring a good boating stage, and pilots do not expect this before November. A few of the prophets, however, cling to the prediction that tows will be taken out before Hallowe'en. The stage of the water at Davis' Island dam last night was 1.3 feet; river stationary."

As a matter of exact record the lowest stage of water at Pittsburg during September, 1895, was 5.3 feet. In September, 1897, the lowest stage there was 5.2 feet.

This statement is both startling and suggestive, especially when taken in connection with the following information, kindly given by the National Weather Bureau, through Mr. E. R. Demain, the observer at Harrisburg:

"Deficiency of rainfall at Pittsburg from January 1, 1895, to October 15, 1895, was 9.47 inches.

"Deficiency of rainfall at Pittsburg from January 1, 1897, to October 15, 1897, was 3.55 inches."

It would seem from the above that in 1897 the water was lower at Pittsburg than in 1895, though the deficiency of rainfall was in 1897 less than one-half (exactly 37 per cent.) what it was in 1895.

Facts of similar import reach us from other stations. Thus, at Philadelphia, the deficiency of rainfall from January 1, 1895, to October 15, 1895, was 7.42 inches. From January 1, 1897, to October 15, 1897, it was 0.61 inches.

From Erie, Pa., we have these figures, thus: deficiency of rainfall from January 1, 1895, to October 15, 1895, was 8.20 inches. Deficiency from January 1, 1897, to October 15, 1897, was 5.16 inches.

At Harrisburg, Pa., the deficiency of rainfall from January 1, 1895, to October 15, 1895, was 18.95 inches. From January 1, 1897, to October 15, 1897, it was 11.31 inches.

This is one of the problems to be accounted for and remedied if possible. It is evident that there are too many elements of state and national prosperity involved here to permit of any shortage of water power if it can be avoided.

Of course it will be noted that these rainfall data were taken in Pennsylvania, though the origin of a portion of the water supply of Pittsburg is quite beyond our borders. There can, however, be no doubt but that over a large portion of the Allegheny and Monongahela basins the rainfall was greater than in 1895, yet these streams seem to have been lower. There can be no doubt as to the essential fact—that in our periods of annual minimum waterflow, our rivers are delivering less water in each successive year. Thus, the most reliable

estimates at hand now (from Mr. Henry Birkinbine) give the following for the Schuylkill river in its periods of least annual flow at Philadelphia:

1816, there were sent down 500,000,000 gallons daily.
1825, there were sent down 440,000,000 gallons daily.
1874, there were sent down 245,000,000 gallons daily.
1875, there were sent down 245,000,000 gallons daily.
1878, there were sent down 220,000,000 gallons daily.
1881, there were sent down 215,000,000 gallons daily.
1895, there were sent down 195,000,000 gallons daily.

If these figures are correct, as they probably are, it would seem that in 1895 there was available at Philadelphia only 39 per cent. of the water there was in 1816. Or, in other words, that in eighty years 61 per cent. of the water that should have been available during autumn in the Schuylkill, at Philadelphia, had disappeared—that is, if we assume the reported flow of 500,000,000 gallons as a fair average minimum flow for earlier years.

There is a striking fact in connection with the table just given. It is the progressive decrease, and as if to reinforce the belief in the general accuracy, it will be noted that in 1874 and 1875 the flow is stated roundly at 245,000,000 gallons. It is hardly probable that there will be any dispute over the general statement that we are having less flowing water available at the critical season of the year than formerly. How it is to be accounted for is quite another question. Three explanations might be, or are, offered:

1st. That we are passing through a period of less rainfall than formerly.

2d. That the disastrous change is due to disturbing the former balance of natural conditions by removal of the forests.

3d. That much of this missing water has been used before it reaches the point or points at which the estimates were made.

Taking the last of these explanations first, it may be briefly stated that it does not seem possible, or even probable, that the deficiency of flow can be caused by use of water, because, in the first place, the diminished flow is often as marked at the head of the streams, and above any point of use, as it is below. In the second place, very much of what is used is not carried out of the country by the users and must again find its way into the soil, or stream, at, or near, the point of use. In the third place, for that which is carried off by locomotives, either as water or as vapor, almost as large a portion is returned in the one form or the other to the region from some other points. It would be very interesting to learn the exact quantity of water consumed by our railroads.

Of the two remaining explanations that which seems least applicable to existing conditions of water flow is the one which assumes a

diminished rainfall, because sufficient data are not yet available to settle the question as to whether or not there can be fairly said to be any decrease in the quantity of water delivered from the sky—even in recent years. In fact there are places in which we know that during twenty years past the later decade has yielded as much rainfall as the earlier one. Or, if we include in our estimate a term of years measured by centuries and raise the question as to whether or not we are undergoing a cyclic period of drought as compared with earlier periods, then we are simply invoking an hypothesis which itself requires defence.

It, of course, would explain the present diminished flow if we could prove a diminished fall extending through a long term of years, but in seeking and offering such an explanation we are assuming as true that which requires to be proved. The term "cyclic change" is euphonious and seductive, but as a matter of fact we know as little about cyclic changes as we do about almost any terrestrial condition. In reasoning with them for a basis we argue not upon what we know, but upon what we do not know.

Apropos of this we may quote from Bulletin D, United States Department of Agriculture, page 18, "Rainfall of the United States," by Alfred J. Henry, Chief of Division: "It is true that suggestions of a faint periodicity have been found in some regions of the globe, but it is still the general belief that the vicissitudes of rainfall, if not wholly fortuitous, are so intermingled with the variations of pressure, temperature, etc., that no satisfactory solution of the problem will be reached until the greater problem of the general circulation of the atmosphere has been solved."

In the Monthly Weather Review for September, 1897, page 395, Prof. H. A. Hazen has gathered together the scattered data which seems to prove more clearly than ever before that the removal of our forests has not appreciably diminished our rainfall—l. c. p. 397, he says: "Observations of this nature, condensation in or over a forest, however, can not ordinarily be checked by instrumental means, but show in a general way that the forest tends to conserve vapor and moisture, which, in the case of the open field, would be diffused into the atmosphere."

There would remain then, the assumption that this diminished flow comes from some change, or changes, made in the hitherto established balance of nature. Of such possible changes the one most frequently invoked is the removal of the forests. These are some of the facts which appear to bear upon the case:

1st. It seems to be proven that there is a diminution in the volume carried in our streams during the dry season, and that this is marked over wide areas.

2d. It is certain that our woodland areas in which water is hoarded are decreasing, and that in the same measure our areas of rapid evapo-

ration, and from which the water flows with greater rapidity after the ground is saturated, are being increased. This period of eighty years, from 1816 to 1895, during which the autumn flow of lthe Schuylkil seems to have been gradually diminishing, is too long a reach to be explained by any cyclic change of which we have any exact instrumental record—and certainly the cyclic explanation must be open to question. The decrease in water flow becomes all the more striking when it is noted that the deficiency of water occurs just at the time when we should expect the effects of the summer evaporation over cleared areas to be most marked.

3d. Any excess of water which flows out of the country in a freshet leaves so much less in the country to maintain the even, average flow of springs and streams.

4th. Competent engineers inform us that as between two similarly situated and conditioned regions, the one, however, being treeless, and the other being timber clad, the latter will absorb of the water which falls, and of the snow which melts, about three-fifths more than the former.

5th. Many of our smaller streams, which once flowed the year through, are now, for a portion of each summer season, either absolutely dry, or nearly so. This is ordinarily supposed to mean merely so much water cut off from the larger streams by previous stages of high water. But as a matter of fact it means also a dry atmosphere over a large portion of our cleared areas, which dry air evaporates, by so much, the water from the larger streams. We cannot here give the exact ratio of evaporation, but it probably aggregates an immense volume of water.*

6th. It is now frequently seen that the "green woods" burn in our forest fires, and that formerly they very seldom did so. This means that the normal condition of a saturated atmosphere which once existed has changed, and that, instead, we have an air from which much of the moisture has been evaporated, because the forest areas of slow evaporation have been changed into cleared areas of rapid evaporation, and that the latter areas tend to a constant equalization of the quantity of moisture in the air by drawing upon and drying out even the green woods.

7th. While our river guages have thus far not clearly indicated periods of higher water, the fact remains that our county commissioners are continually raising the height of our bridges above the stream to keep them out of the way of the flood.

It would thus appear that in the loss of water retaining power in the cleared ground and in the increase in the rate of evaporation over the remaining water surfaces there is good reason to associate, at

* Mr. Rafter (op. cit. p. 157) writes, "I reach the conclusion that the deforestation of a drainage area will, in the state of New York, probably decrease the annual water yield of that area from four to six inches."

least in part, the unusually low water during our summers with the removal of our forests.

Of course no one desires to see any suspension of legitimate lumbering interests. The whole object of the forestry agitation is to perpetuate the lumbering interests, and in protecting them also to insure for the State an abundant water power for the future. We may well weigh the statements in the "Manufacturers' Gazette," for October 30th, page 12, where, under head of the gratuitous power furnished by nature, the following occurs:

"Districts long neglected must become populated. Consider what the Falls of Montmorenci might do for Quebec; what the Falls of Ohio might do for Louisville. How Maine will grow when the Penobscot and Kennebec shall have been properly harnessed! Think of the transformation that must go on in our Susquehanna Valley when the water's energy shall have been turned to full account. No state in the Union is more suited to this sort of evolution than Pennsylvania, with her uncounted copious streams in fertile valleys and her great natural wealth. Some such transformation seems bound to come; and it would be no greater than has twice been wrought in this century, first for hand labor, and then by the general introduction of steam. The use of steam is an artifice. The nearer we get to nature, and the free use of her gifts, the less we depend upon the artificial."

Under existing conditions, where is the loss of water power to end? This raises one of the most important questions before our thinkers, workers and legislators to-day.

For a thoroughly exact and reliable solution of the relations of the forests to the water flow of the State, we should require much more information than we now possess. While this is true, it is also equally true that there are certain well-founded principles upon which reasonably exact and safe conclusions may be based, and that in order to formulate information for the public benefit we are justified in using the knowledge we already have.

For example: No one who will weigh a mass of dry leaves and weigh that same mass after it has been exposed to the rain will doubt that leaves possess the power of retaining water. Furthermore, he would recognize that while the water from above readily permeated the mass of leaves, as they lay upon the soil, and entered into the earth, that at the same time these very leaves, being themselves saturated with moisture, would act most efficiently in retarding the evaporation of the surface water in the soil. These facts are so plain that no one can avoid recognizing the water retaining capacity of the leaves which lie upon the forest floor. If we change the point of observation from the forest to the field and study the constitution of the densest sward we cannot fail to recognize that above the surface of the earth no such water-retaining layer exists, or if it is there, it will be less thick and less densely matted. Evaporation will go on much more rapidly in it

than in the forest. Then, too, another point in favor of the forest is the fact that in it the soil itself is more efficiently shaded than in the field. From these observations alone one must conclude that when the land is changed from a forest to a field condition there will follow a large loss of water by evaporation.

It is just as obvious, when one stops to examine, that during a heavy rain the conditions existing in the forest are such as to retain a larger portion of the water than is held by the field. In other words, much of the water, which soaks into the ground in the forest, flows off as surface water from the field and is almost at once carried out of the country.

Let us make this statement as exact as our present information will allow. On pages 17 and 18 of the report of Major C. W. Raymond, United States Engineer, upon Flood Protection of the City of Williamsport, we find the following statement: "Colonel Torrelli affirmed as the result of careful observation that four-fifths of the precipitation in forests is absorbed by the soil or detained by the surface of the ground to be gradually given up in springs and gentle rills. And only one-fifth of the precipitation is delivered to the rivers rapidly enough to create floods. Upon the same slopes and surfaces, denuded of their forests, the proportions are reversed."

That is to say, in the forests four-fifths soak into the ground and in the fields but one-fifth succeeds in doing so—hence then there is a saving by the woods of three-fifths of the water-fall over that of the fields.

It will be interesting to note just what this means. From data collected by this office it appears that in the year 1896, in the counties of Clarion, Forest, Indiana, Jefferson and Warren, in the State of Pennsylvania, the areas cleared of timber aggregated about thirty-two square miles. These counties drain almost wholly into the Allegheny river. It is not possible as yet to obtain the exact annual rain fall for the region. It is safe, however, to place it at thirty-eight inches. The quantity of water falling upon thirty-two square miles would be 4,881,619,353,600 gallons. In an United States gallon there are 231 cubic inches. Dividing the number of cubic inches of rainfall by the number of cubic inches in a gallon, we would ascertain that the rainfall aggregated 21,132,551,314 2-7 gallons annually over the thirty-two square miles cleared. If this rain fall were converted into a stream one foot deep, one hundred and twenty-five yards wide, and which flowed at a speed of four miles an hour, it would require fourteen days, twenty hours, forty-one minutes and thirty-five seconds to pass a given point. If it were converted into a solid cube it would form a mass of water 471.21 yards in length, width and depth.

If the statement of Colonel Torrelli is to be depended upon, the removal of timber from those thirty-two square miles would mean that

four-fifths of this vast volume of water, instead of soaking into the ground to slowly percolate into the streams of the Allegheny Valley and to aid in maintaining an even flow of water, was allowed to run hastily from the surface, into the streams and out of the country. If it did not create a freshet it was, at least in great part, wasted. It was, in other words, so much power rendered unproductive and carried beyond our reach.

It may be that the estimate of Colonel Torrelli is too large. Any authority quoted approvingly by Major Raymond is, however, likely to be as nearly correct as the science of his time allows. We are content to state the case, and without insisting upon these figures, to stand positively upon the principle which they indicate.

The real, practical point for those interested in the future of that region is to determine for themselves where this progressive loss of power is to end.

Is there any probable benefit to be expected in the way of preservation of this water, with the power it implies, by restoration of forests on land, otherwise barren, at the heads of the streams?

If so, is it not supreme folly to delay such restoration an hour longer than necessary?

If forests are not restored to this barren ground, to what other use will it be put?

Can any State afford to have any portion of its areas unproductive?

Do not barren areas reduce the income of a State by depriving it of the revenue it otherwise should yield?

There are two stages more or less clearly defined in the history of every reform movement. One that of agitation, and the other that of actual operation. It appears to be certain that in this State the second stage has been reached.

The forestry operations commenced some years ago by the custodians of the Girard estate in Schuylkill county appear to be in a prosperous condition, and those under the same management in Centre county are yielding object lessons of great value in protection against forest fires. The most notable advance in a practical direction is that made near Ridgway, in Elk county, where on land generously provided by Mr. N. T. Aronld, the general government has undertaken the work of conducting an experimental forestry plantation. This work was commenced with the full knowledge and consent of your Commissioner of Forestry, between whom and Mr. Fernow, in charge of the Forestry Division in the Department of Agriculture, in Washington, there exists a perfect understanding and a hearty sympathy. It is but fair that it should be under direct control of the general government. The location in the heart of what was once the lumbering region of Pennsylvania, is most fortunate, and important results may be hoped for from the experiment. A liberal public spirit would welcome all help of this kind from any source whatever.

There cannot be too many such experiments tried. Whatever benefit accrues from them will be most largely reaped by the region in which they are conducted. For the first time in the history of the State there are indications that some of the large tracts from which the timber has been removed will soon be placed under competent forest management.

In order that there may be no misapprehension or misunderstanding as to the full meaning of the recent legislative enactments concerning forest fires, copies of these have been provided, and it is hoped that early in the new year every constable and every county commissioner within the limits of the Commonwealth will be fully informed upon the new duties which these laws have imposed upon them. We shall also see that they are circulated among such of our citizens as have an interest in them and who would be likely to call attention to any neglect to enforce them.

The public interest in the work of the Division of Forestry is evidently on the increase. Inquiries for information from this office almost invariably receive a prompt reply, and spontaneous offers of help from influential citizens are of daily occurrence. We have sent out during the past year about twelve thousand, five hundred circulars to the officials and citizens of the State. Most of these contained questions upon subjects which were under investigation here. The remainder were reports or copies of recently enacted forestry laws.

Respectfully yours,

J. T. ROTHROCK,

Commissioner of Forestry.

REPORT OF THE DAIRY AND FOOD COMMISSIONER.

HARRISBURG, PA., January 1, 1898.

HON. THOMAS J. EDGE, SECRETARY OF AGRICULTURE:

Dear Sir: I have the honor to report the following review of the work of my Division of the Department of Agriculture, for the year 1897.

Work under the act of June 26, 1895, known as the pure food law, has been effectively carried on in nearly all sections of the State, and under its provisions, I think it is safe to say, that nine-tenths of food adulterations have been banished from the State. The saving in dollars and cents that this amounts to, for our citizens throughout the entire State, is a vast sum every year. The amount appropriated for the enforcement of the law is a mere trifle as compared to the amount saved. The law is generally popular and a large majority of dealers seem disposed to observe it. This makes it comparatively easy to execute.

We were crippled for a time in the proper enforcement of the law from an adverse decision rendered by Judge Hemphill of Chester county, in pronouncing the pure food law unconstitutional, from defect in title. This decision was appealed from, and on April 19, 1897, Judge Orlady filed the following opinion, reversing the decision of the lower court:

Commonwealth vs. William C. Curry.	Appeal from the Quarter Sessions of Chester County. Filed April 19, 1897.

"The defendant was convicted on an indictment framed under the act of June 26, 1895, P. L. 317, in which it was charged that he "unlawfully then and there did sell and offer for sale, as and for, and in imitation of, and under the name of olive oil, used for food by man, a large quantity of a certain adulterated article and compound, the name and components of the said adulterated article and compound being to this grand inquest as yet known," and in a second count "unlawfully did then and there sell and offer for sale, as and for olive oil, used for food by man, a large quantity of a certain adulterated article and compound, then and there being an inferior and cheaper substance and compound substituted for olive oil, the name and components of said adulterated, inferior and cheaper substance and compound being to this grand inquest as yet unknown."

The verdict was set aside and the defendant discharged by the court below; the reason given in an opinion filed was, "As there was no evidence of the sale of an adulterated article of food, it was, at most an imposition or deception in the sale of one article under the name of another, and as the prohibition contained in clauses two and four of the third section are clearly not within the act as expressed in its title, and therefore unconstitutional, the verdict must be set aside and the defendant discharged."

The defendant sold "cotton seed oil" in packages labeled and marked "olive oil," and defends his conduct as lawful because the act of June 26, 1895, known as the pure food law, is misleading, in that the title does not invite an examination of the body of the bill, in which the offense charged is defined as an adulteration.

The learned judge in the opinion filed says: "While the meaning of words depends upon popular usage, the Legislature has the right to prescribe legal definitions of its own language.

But admitting this right, does not the legislative definition quoted introduce into the body of the act entirely new and additional subjects, not clearly or at all expressed in its title, and thus violate the third section of article III, of the Constitution? Both, it is true, relate to food, but the title of the act is not to regulate the manufacture and sale of food, but is restricted to food of a certain character, namely, adulterated food, which the article sold in this case was not." The last part of this statement begs the whole question, as by the act, it and all similar articles ("Second. If any inferior or cheaper substance or substances have been substituted wholly or in part for it;" Fourth. "If it is an imitation of or is sold under the name of an other article"), are declared and defined to be adulterations within the meaning of the act.

It is conceded that the Legislature has the right to prescribe the legal definitions of its own language. A construction put upon an act of the Legislature itself, by means of a provision embodied in the same that it shall or shall not be construed in a certain designated manner, is binding upon the courts, although the latter without such a direction, would have understood the language to mean something different. Endlich on Statutes, section 365. It is legislative language we are to construe, and it must be received not necessarily according to its etymological meaning, but according to its popular acceptation, and especially in the sense in which the Legislature is accustomed to use the same words. Phila. & Erie R. R. Co. vs. Catawissa R. R. Co., 53 Pa. 20.

The sense given to particular words by our great lexicographers is always entitled to weight, yet when a word is used in an act of Assembly, regard must be had to the circumstances surrounding its use. Penna. R. R. Co. vs. Price, 96 Pa. 256.

It is contended that the term 'adulteration" is given a special definition by the act by which a new and additional subject is introduced, not clearly, or at all expressed in the title, in contravention of the third section of article III, of the Constitution, "No bill except general appropriation bills shall be passed, containing more than one subject which shall be clearly expressed in its title." We are not required to resort to the technical meaning and derivations of words as given in dictionaries to determine the legislative meaning, when the words are defined by statute, and in this case it is not inconsistent with the common acceptation.

The definition given to the word "adulteration" in this statute is so intimate and natural a connection, so evident an adjunct of the subject and is so closely associated with the word to which it refers that it cannot be held an independent or separate subject, but fairly gives notice of the legislative purpose through the title.

The term adulteration is derived from the Latin adultero, which in its various inflections signifies to defile, to debase, to corrupt, to sophisticate, to falsify, to counterfeit, etc. The objects of adulteration are four-fold, namely, to increase the bulk or weight of the article, to improve its appearance, to give it a false strength, or to rob it of its most valuable constituents.

All these adulterations are manifestly of a designedly fraudulent character, and therefore properly the subject of judicial inquiry. Vol. I, Enc. Brit., Am. reprint, 9th ed., p. 152. Title, adulteration.

It was held in Commonwealth vs. Moore, 2 Pa. Superior Court R. 162, an act, the title to which was, "An act for the protection of livery stable keepers," was constitutional, because the title fairly gives notice of the subject of the act, so as reasonably to lead to an inquiry into the provisions of the bill, which has repeatedly been held to be sufficient, as the title thus inducing examination, accomplishes all that a more elaborate statement would give notice of. Millvale Borough vs. Evergreen Ry. Co., 131 Pa. 1; Keely vs. Mayberry Township, 154 Pa. 440, and Commonwealth vs. Lloyd, 2 Pa. Superior Court R. 6, in which case "An act relating to the county commissioners of Cambria county" was sustained, though the second section fixed the salary of each commissioner, and the third section authorized them to employ a clerk at a fixed salary; and on appeal to the Supreme Court, 178 Pa. 308, the judgment of the Superior Court, was affirmed for the reasons given.

In Commonwealth vs. Robert Muir, 1 Pa. Superior Court 578, an act, entitled "An act to regulate and license public lodging houses in the different cities of this Commonwealth," in which a "public lodging house" was specially defined in limitation of the common meaning of the words, was held valid and constitutional, and on appeal to the Supreme Court, 180 Pa. 47, that tribunal says, "We have considered

the provisions of the act and are all of the opinion that the Superior Court was clearly right in holding that it is constitutional," though it contained subjects not technically covered by the title.

The title to this act, "To provide against the adulteration of food, and providing for the enforcement thereof," would naturally invite inspection by any one engaged in the manufacture or sale of food, and desirous of knowing what was to be avoided in the making and trafficking in the multiform food products of this day.

The attempt to defraud the public in selling cotton seed oil under the guise of a higher priced article of an entirely different name is one of the many similar acts which necessitated the pure food law, and useful and honest legislation should not be defeated by too rigid an adherence to the letter of the Constitution, or pretexts be caught at to void legislation when it can be fairly reconciled within constitutional limits. It is a cardinal rule that all statutes are to be so construed as to sustain rather than ignore them; to give them operation if the language will permit, instead of treating them as meaningless and invalid. Mauch Chunk vs. McGee, 31 Pa. 433.

The title does not tend to mislead, as it invites examination by the very words used, "To provide against adulteration of food, and providing for the enforcement thereof," which reasonably embraces every product; the different classes, kinds, modes of manufacture; and as it was a proper subject for legislative action, all persons, whether manufacturers or dealers, are attracted by the words of the title to a critical examination into the provisions of the bill.

There has been a general disposition to construe the constitutional provision liberally, rather than to embarrass legislation by a construction whose strictness is unnecessary to the accomplishment of the beneficial purposes for which it has been adopted. Cooleys Const. Lim. 175.

In addition to the reasons herein given, we refer to Commonwealth vs. Daniel D. Jones, and Commonwealth vs. Huffnal, filed at this term, in which cases the same subject is discussed.

We do not agree with the reasoning of the learned judge below, and think the title to this act fairly gives notice of the provisions of the act, so as to reasonably lead to an inquiry into the bill.

The assignments of error are sustained. The decree of the court below is reversed, and record remitted for further proceedings thereon."

The question regarding the admissibility of butter colors made from coal tar, was after much controversy, adjusted on the plan of a cautionary notice being on the label, that it should only be used according to printed directions, and also a printed notice of the material of which the color was composed, and the removal from the label the statement that it was a harmless vegetable color.

In a dry mustard case, adulterated with 70 per cent. of wheat flour, that was tried in Monroe county, it was claimed on the part of the defense, that mustard was not an article of food; hence did not come under the provisions of the law. A local doctor was called for the defense and testified that mustard was not an article of food, and further, that it was poison. The State Chemist in rebuttal, testified to exactly the reverse, naming the different properties of which mustard was composed, specifying what was nutritious, and that the trace of poison existing in natural mustard, was eliminated in the prepared article; and that as prepared for commerce, it was not poison, and was an article of food. The court in submitting the case to the jury, charged, that whether mustard was or was not an article of food, was a question of fact for them to decide. As it proved, the jury were divided on the question, and rendered a compromise verdict, acquitting the defendant, but imposing upon him half the costs, and the other half on the county.

In August last, a meeting of the Dairy and Food Commissioners of different states, was held at Detroit, Michigan, and a National Association was organized, with J. E. Blackburn of Ohio, President, and Elliott O. Grosvenor, of Michigan, Secretary.

A constitution, by-laws, &c., were adopted, providing for annual meetings of the association.

We can reasonably expect much good to result from these yearly meetings; where questions of interest connected with the departments of the various states, can be discussed, and views and experiences interchanged. This will be advantageous to all, and result in uniformity of action and construction of the various laws.

The Department of Agriculture at Washington, some time since, authorized Hon. Alex. J. Wedderburn, as a special agent to investigate and report upon the advisability of a national law, governing the subject of adulterations in foods and drinks. He has closed his investigations, but the report as yet has not been published, though I am informed that an act pertaining to this subject, will be formulated and presented at the present session of Congress.

Since my last report a new vinegar law has gone into effect, and all the old laws have been repealed. The legal standard of solids in cider vinegar, is reduced from two, to one and a half per cent. This seemed to have been warranted, from some experimental work carried on under the direction of the Secretary of Agriculture, whereby some sixty samples of known cider vinegar were analyzed by Dr. Frear, by which it was found, that many of the samples fell short in solids of the legal standard as it then existed.

Another important change in the vinegar law relates to color. Artificially coloring in any vinegar is prohibited. As distilled vinegar is colorless or nearly so, and the popular demand is for an amber colored vinegar, manufacturers claim, that an injustice is done to them, by in-

serting this color clause, as the material used for coloring (burnt sugar) is harmless. On the other hand it is claimed, that colored distilled vinegar is often sold as cider vinegar, and that it is imposisble to practice this deception when vinegar is uncolored. The old law required the Dairy and Food Commissioner, to make a detailed report, to the State Board of Agriculture, at their annual meeting of work done under the vinegar act. The new law changes this, placing the whole responsibility of enforcing the law by the Dairy and Food Commissioner, upon the Department, and not upon the State Board of Agriculture, as formerly. The standard of acidity under the law remains as before, at four per cent. or forty grains. At the present time vinegar is generally sold true to name, and much of the deception formerly practiced has been done away with.

Another important act passed by the last Legislature, the enforcement of which devolves upon this Department, is the cheese law. Formerly cheese of any grade could be sold within the State, without restrictions, whether full cream or skimmed, or of an intermediate grade. Often full skim, or any intermediate grades, were sold as full cream; especially was this the case with Ohio part skim cheese, and the result was, that while such cheese might be a desirable article of food, that it was sailing under false colors, and that consumers were deceived as to its quality.

They often paid the value of a full cream cheese when they were getting an inferior and cheaper article. The law referred to not only fixes standards of quality, but requires that they shall be branded "full cream," "three-fourths cream," "half cream," "one-fourth cream," and "skim cheese" as the case may be. The standard fixed is 32 per cent. of fat for full cream, 24 per cent. for three-fourths cream, 16 per cent. for half cream, and 8 per cent, for one-fourth cream, and that all cheese containing lass than 8 per cent. of fat, shall be branded "Skim Cheese."

At first the trade very generally thought that the standard fixed by this law was foo high, but repeated analyses of known full cream cheese soon convinced them, that this fear was entirely unfounded, and that the standard of 32 per cent. fat, was a minimum rather than an average standard. Many manufacturers of the State were also in doubt about their ability to comply with the law, and many letters were received at he Department, asking what per cent. of fat in milk, was necessary to produce a 32 per cent of cheese. We explained the matter in this way: that as it takes on an average ten pounds of milk to make one pound of cured cheese, hence a pound of cured cheese, contains (not allowing for waste), just ten times the per cent. of fat, that the milk contained from which it was made.

There always will be some waste of fat in manipulating the curd, the amount depending greatly upon the care with which it is handled.

All good cheese makers strive to retain as much of the fat as is possible, and I think it is safe to calculate, that three and a half per cent. of milk would produce a cheese, that would test up to the legal standard.

This would be allowing three per cent. for waste, from the amount of fat contained in a quantity of milk, sufficient to make a pound of cheese. While there are individual cows, whose milk may show a percentage of fat at three and a half per cent. or lower, yet I very much doubt if there is a cheese factory in the State, at which the milk from the aggregated herds that supply it, will not show a percentage of fat above three and a half, unless there is some skimming done, either by the patrons, or the manufacturer. Factory men who have applied to me for information on the subject, have been advised that they need have no fears of falling short of the requirements of the law, provided, they allowed no skimming done by their patrons, and did none themselves.

Another feature of the law that caused considerable apprehension of trouble among jobbers and wholesale dealers was the clause that required the manufacturer's name and postoffice address, from the fact that many domestic and foreign cheese came into their hands unbranded, and that it was impossible for them to know who the manufacturer was. A liberal construction from the Attorney General of the intent of the law, allowing the dealer to brand his name on the package in place of the manufacturer, obviated this difficulty, and now everything is working very satisfactorily.

I insert the opinion of the Deputy Attorney General in full, as follows:

Office of the Attorney General,
Harrisburg, Pa., October 27, 1897.

Hon. Thomas J. Edge, Secretary, Department of Agriculture:

Sir: The answer to your request for an interpretation of the act of June 23, 1897, has been very much simplified by the presence of gentlemen representing the trade. From them it was learned that at least three-fourths of the cheese consumed in Pennsylvania is manufactured out of the State, and in many instances it is impossible to ascertain the name and address of the manufacturer thereof. A jobber in New York City, for instance, may buy cheese from any other State or even from foreign lands, and it will be impossible for him, in all cases, to know where and by whom the product was manufactured, and it would be out of the question, in such case, for the wholesale or retail dealer in Pennsylvania to obtain that information.

It is contended however, that the act of June 23, 1897 (P. L. 202), requires the dealer to brand the cheese with the words "Full Cream," "Three-fourths Cream," &c., according to the class to which it belongs,

and also with the name and address of the manufacturer. This last requirement, as we have seen, is, in many instances, impossible of performance. The law does not require the performance of an impossibility. The whole purport of the act above named is doubtless to prevent the sale of any cheese not the legitimate product of pure unadulterated milk or cream, and at the same time provide the means of identifying the person who may be responsible for a violation of the act.

Supposing it were possible to label every cheese manufactured out of the State with the name and address of the manufacturer, how could that aid in protecting the consumer? The manufacturer is beyond the jurisdiction of the authorities of this State, and no punishment can be inflicted on him in case of violation of the provisions of the act of Assembly. It would seem to be more consonant with the purpose of the act to allow the dealer in such cases to mark with his name and address as dealer all such cheese, as thereby he would himself indicate his personal responsibility in case of a violation of the law.

The act also provides that the brands on the cheese shall be in "bold-faced capital letters not less than one inch in height." The gentlemen who appeared before us showed very clearly that in some cases it would simply be impossible to comply with this provision of the law, inasmuch as many cheeses are too small to allow the amount of printing in the type as required by the act. In such case the obvious thing to do would be to come as near as possible to the requirements of the law.

With these observations I therefore advise you as follows:

1. That in case of cheese manufactured in Pennsylvania. you should require the same to be branded "Full Cream," "Three-fourths Cream," &c., as the case may be, and with the name and address of the manufacturer thereof.

2. That in case of small cheeses, you should require the words "Full Cream," "Three-fourths Cream," &c., to be printed in large letters and allowing the name and addresses in smaller type, which, however, should be clear and plain, and which ought not to be less than one-half inch in height in any instance.

3. In the case of cheese manufactured out of the State, it would be a sufficient compliance with the act of Assembly above named, if the dealer would brand the same in the manner indicated, with his name as dealer thereon, and with his address or place of business also thereon. I am fully convinced that in this way complete effect would be given to the act and the interests of the consumers, as well as the Commonwealth, would be best protected.

Very respectfully,

WILBUR F. REEDER,

Deputy Attorney General.

8--6--97

OLEOMARGARINE.

As predicted in our last report, the fallacy of being able to sell oleomargarine legally under the pure food law as a compound not injurious to health has been passed upon by Judge Arnold of Philadelphia, and the position taken by oleo dealers was not sustained. In Pittsburg, however, in a number of cases taken up on a writ of certiorari, the judgments obtained in favor of the defendants for costs were affirmed without, however, passing upon the legal question involved. To my knowledge no further claim has been made that the pure food law legalizes the sale of oleomargarine in this State. In Pittsburg, where large quantities were sold in this manner, a vigorous enforcement of existing laws is being carried on under the direction of Attorney Moore and Agent James Terry, and both friends and foes of the sale of oleomargarine claim with good effect, by greatly reducing the illegal traffic.

The output of oleomargarine has been reduced one-half a million of pounds during the last year as shown by reports from the Internal Revenue Department, licenses, &c., and two millions as compared with 1894. The amount of oleomargarine manufactured and sold as compared with butter is less than two per cent., and while it has an injurious effect upon the dairy industry, it is not the only cause leading to the prevalence of low prices for dairy products.

Renovated or made over, sometimes known as boiled, or process butter, is on the market in large quantities, and this has a depressing influence on prices. It is produced from a grade of butter which, before it is manufactured, brings only about what it is worth for soap grease, in fact the lowest grade of butter to be found in country stores. The fat is rendered from it by boiling, and this is the only portion used. It is deodorized and again churned in milk from which it derives about the usual amount of casein. After churning it is washed, salted and worked much as ordinary butter is treated. It has not the grain of ordinary butter and when tried by the heat test, it behaves like oleomargarine. As it contains no foreign fat it cannot be classed with oleo, and its sale prohibited under the act of 1885, though as an article of food it is doubtless more objectionable than oleomorgarine, and it is liable to become as great a menace to legitimate dairy interests. Some cases have been brought under the pure food law in Philadelphia against its sale, but what the final outcome may be cannot yet be determined.

Since my last report another fraud in butter manufacturing has been unearthed. This seems to have been confined to creameries, and we have prosecutions now pending in Montgomery county. A material called a cream ripener but in reality a low grade of cotton seed oil and stearine is added to the milk or cream before churning. This, of course, increases the yield and the profits, and when used in small

quantities it is difficult to detect. It is not only a violation of the pure food law, but also of the United States Internal Revenue laws, for one using this foreign fat with butter becomes under the statutes, an oleo manufacturer, and subjects himself to the penalties in not having taken out a license. It is to be hoped that the few prosecutions brought may have the effect of preventing any further infringement of State and National laws by such fraudulent practices among creamerymen.

Strenuous efforts were made at the last session of the Legislature to get some new act governing the sale of oleomargarine, that would under certain conditions, legalize its sale. One bill contained a clause that it should not be colored yellow in imitation of butter. Another bill introduced included a license system. Had this act become a law, it would have been a source of considerable revenue to the State, and, owing to the falling off of revenue and the necessity of increasing the same, this plan at one time had quite a strong following. When, however, members from the agricultural districts began to hear from their constituents, they found that public sentiment was against such measures, and the idea of raising revenue from this source was abandoned.

Some prominent dairymen who do not fully approve of prohibitory laws recommend in their place what are generally known as color laws, and acts of this kind are now in force in the following states, namely: Colorado, Illinois, Iowa, Massachusetts and Michigan. In Vermont and West Virginia it can be legally sold when colored pink.

After strenuous efforts a law of this kind was passed last winter in Illinois, prohibiting the manufacture or sale of oleomargarine colored yellow in imitation of butter. The law, however, seems to be disregarded as there is no apparent difference in the color of the goods they turn out from Chicago from former years, though a bill one of our agents secured had stamped upon it "Uncolored Butterine" which might be called "obeying the law by letter" if not otherwise.

While business depression has so generally prevailed, dairy interests have suffered, though as we believe, in a lesser degree than most lines of agricultural pursuits.

Adversity is a stern teacher, and many useful lessons are thereby imparted. Dairymen are thus brought to realize the absolute necessity of a rigid inspection of their business in view of retrenchment and economy; seeking whereby expenses can be lessened and profits increased. To this end one very important consideration is to fix upon a high standard of excellence for the product placed upon the market, whether it be milk and cream or the manufactured article of butter or cheese. I have always maintained that if all of the butter offered for sale was up in quality to the high standard of excellence that it might, and should be, that this alone would settle the oleomargarine question.

The main cause of the demand for oleomargarine arises from the fact that so much poor butter is found on our markets; to raise the standard to its proper plane would seldom require any additional expense, but simply to do the right things at the right time in a careful manner, associating with the work painstaking methods derived from an intelligent study of the subject.

Another year's experience has clearly proven the value of the laws relating to pure food, vinegar, lard, and other food products, and it is difficult to even estimate the saving which their enforcement has given to the people of our State, and it is also evident that their enforcement in the future will gradually become more easy as our people and especially as our retail dealers in food products become educated to the improved methods inculcated by a strict compliance with the law. I am again able, with increasing force, to call attention to the good effects which have been produced by following the advice of the Department in requiring guarantees from wholesale dealers as to the character and purity of the goods purchased; such guarantees practically relieve the retail dealer from all responsibility, provided the wholesale dealer is responsible for his guarantee.

Respectfully submitted,

LEVI WELLS,

Dairy and Food Commissioner.

REPORT OF THE STATE VETERINARIAN.

HARRISBURG, PA., January 1, 1898.

HON. THOS. J. EDGE, Secretary of Agriculture:

Dear Sir: I have the honor to submit to you the following report on the work of the Veterinary Division of the Department of Agriculture and of the State Live Stock Sanitary Board, for the year 1897.

During the past year this work has assumed large proportions, and it is still increasing in volume, and, I believe, in importance to the live stock interests of the State. For the sake of convenience it may be classed under the following heads:

First. The examination of animals reported by owners or veterinarians as probably afflicted with dangerous, contagious or infectious diseases, and advice and the employment or enforcement of curative or preventive measures in connection with the same.

Second. Correspondence and advice in relation to the treatment of diseased animals and the prevention of disease.

Third. The inspection of tuberculous herds upon written request from their owners and the appraisement and destruction of tuberculous cattle found in such herds.

Fourth. The supervision of the inspection of dairy herds for the purpose of granting certificates showing their condition, such certificate being used by the owners to advance the sale of their product.

Fifth. The laboratory study of diseases that are as yet imperfectly understood for the purpose of ascertaining new facts in reference to their causes and the means that may be employed to prevent them or for the purpose of making or confirming a diagnosis. The laboratory has also produced all of the tuberculin, mallein, and anthrax vaccine used by the Board during the past year.

Sixth. The preparation of articles, reports and bulletins on subjects relating to the health of live stock.

Seventh. The inspection of dairy cows and neat cattle for breeding purposes coming into the State as provided for in the act of May 27, 1897. Although this act does not go into effect until the first of January, 1898, and actual inspections under it have not actually commenced at the time of this writing, it has been necessary to devote much time and attention to preparation for this inspection and to furnish information to shippers and others in reference to it.

Eighth. The investigation of the diseases of animals under the provisions of the act of June 15, 1897.

If the rapidity with which the work of the State Live Stock Sanitary Board has increased can be regarded as an index as to its necessity and value we are justified in assuming that work of this character is both urgently needed and highly appreciated. In fact, the growth of one portion of our work, that relating to the inspection of herds for tuberculosis, has grown to such large proportions that it has been necessary to restrict it in several ways.

Applications from herd owners for examinations of herds and tuberculin tests have been received in such large numbers that it has been quite impossible with our available resources to comply with all of them. Hence, the plan has been adopted of requiring each applicant for'a test of herd to state his reasons for believing that tuberculosis exists among his cattle. Where these reasons are deemed sufficient the inspection is made, but unless there is good reason for this belief the owner of the cattle is furnished with information in reference to tuberculosis, the manner in which it spreads, the means to be adopted in combating it, etc., and is told that it is necessary to restrict inspections to herds in which the apparent danger is greatest. This plan has served to restrict the work directed toward the suppression of tuberculosis to the worst centres of disease that have been brought to our notice, and the percentage of tuberculosis found under these conditions is necessarily very much higher than the percentage of tuberculosis among all of the cattle in the State and furnishes no basis for an estimate as to the percentage of tuberculosis among the cattle at large. However, the statistics of the tuberculin tests of cattle for the last six months, as compared with those made previously, present a remarkable significant feature.

The number of cattle tested up to 1st of June, 1897, was 9,108, the number of these that were found to be tuberculous and condemned was 1,839. The percentage of tuberculosis, therefore, was 20.39. Since the 1st of June, 4,887 cattle have been tested with tuberculin and of these 671 were found to be tuberculous and killed, equivalent to 13.73 per cent. Considering the manner in which the herds to be tested are selected and the wide distribution of the work, covering practically all parts of the State, it would seem fair to assume from this showing that many of the most thoroughly infested herds have been discovered and disposed of, *and that the percentage of tuberculosis among cattle at large is being steadily and rapidly reduced.* This is indeed an encouraging condition, and I believe that it justifies the plan that has been adopted for meeting this disease.

At the time of the publication of the last annual report the average appraisement for cattle condemned as tuberculous was $24.42. Since the beginning of the last fiscal year the average appraisement has

been $20.45. The total payments for tuberculous cattle to date amount to $57,191.16 for 2,510 animals. Since the beginning of the present fiscal year 671 cattle have been appraised at $13,714.66, being an average of $20.45 per head as against $22.78 per head for all of the cattle that have been appraised since the beginning of operations, and $24.42 per head as the average for last year.

It is pleasant to be able to report that there is now a general appreciation of the fact that the State Live Stock Sanitary Board is organized and is working for the suppression of diseases that cause great and burdensome losses every year and that its function is to check these losses and assist those who are suffering them. It is recognized by the Board that there are large commercial interests at stake, and that this work should be so arranged and conducted as to interfere as little as possible with the routine of the business of the farmer, and that it should be so managed as to increase confidence in animal products and have a tendency to enlarge the market for them. At the same time, it is believed that the work is without justification unless it has a permanent sanitary value and succeeds in protecting the public and the general live stock interests as well as the individual. This community of interests, this plurality of objects to be achieved and of obstacles to be avoided, has given us a problem that has taxed the knowledge and ingenuity of numerous officials and boards in this and other countries.

Whatever objections have been raised in other states to work looking toward the suppression of tuberculosis of cattle, they are not based on a desire that the disease shall not be suppressed, but upon the methods employed and expense involved. Some of the methods in use elsewhere have placed such burdensome restrictions upon dairy farmers that the measures have become exceedingly obnoxious to them, and in order to obtain a modification of methods they have in some cases objected to the execution of all plans carried out for the purpose of suppressing tuberculosis. This has caused a false impression and in some places led to the belief that farmers are opposed to the whole work of suppressing tuberculosis, but in Pennsylvania this is not the case. The farmers here want healthy herds.

The plan of voluntary inspections that has been adopted has made it impossible for anyone to object to an inspection of his cattle. The question might be raised as to this plan that it does not sufficiently insure the inspection of herds that are notoriously diseased and are supplying milk for the public market and distributing tuberculous animals which carry the disease into other herds. But the answer to this objection is that consumers, dealers and creameries do not knowingly purchase the product of tuberculous cattle. As soon as it is known that a given herd is tuberculous, the market for its product becomes restricted to such an ex-

tent that it is to the business advantage of its owner to apply for a test of his herd and remove the tuberculous animals. Moreover, public sentiment, and the influence of his neighbors will often lead to an application for inspection where tuberculosis is known to exist; but the usual impelling motive is the desire upon the part of the owner of the cattle to avoid a source of danger and of loss.

In my last report I advised the continuance of the present plan of dealing with tuberculosis and in view of the enlarged demand from live stock owners for assistance under this plan and the success that has rewarded our operations under it, I am of the opinion that its general principles should not be changed.

There is, however, an important matter that I should like to present for consideration with a suggestion as to an extension of the present work. Herd owners for whom inspections are made, sign an application in which they agree to thereafter observe the precautions and measures advised by the State Live Stock Sanitary Board for the prevention of the reintroduction of tuberculosis into their herds. Among such precautions is one in relation to cattle purchased for addition to the inspected herds. Owners of such herds are advised to buy cattle only subject to the tuberculin test or from herds that they have good reason to believe are free from tuberculosis. But many dairymen have difficulty in purchasing according to these provisions. They are to buy cattle that are gathered from unknown sources by drovers, shipped long distances, and disposed of at public sales in dairy districts. The seller offers no guarantee as to the freedom of such animals from tuberculosis, and it is known from repeated observation that many of them are so afflicted. The new law and regulations (act of May 27, 1897) will provide that cattle coming from out of the State, when thus sold, shall be tested and the buyer will have a guarantee as to their condition. But cattle carried from one part of the State to another will still convey disease in many cases. This danger is increased by the fact that some unscrupulous persons knowingly dispose of tuberculous cattle through the channels of trade, under the impression that it is cheaper to do so than to report the disease to the State authorities.

Some dealers have already arranged to sell cattle subject to the tuberculin test and in some cases, also, whole herds are inspected and sold with certificates showing that they are healthy. This system is desirable for the purchaser and it has been observed that cattle sell better with a guarantee of this kind than without it. Many of the leading breeders of the State sell cattle for breeding purposes only under these conditions. It is desirable that this system should be extended as much as possible, because when herds become tuberculous it is usually because the disease has been purchased in the body of a cow or bull.

The principal objection, that has been raised, to the more general practice of testing cattle with tuberculin before they are sold is on the ground of expense. It is held that such inspections will increase the price of cattle. While this effect would be a desirable one from the standpoint of the breeder or dealer, if the cost of inspection were not equivalent to the increase in price, it would be injurious to the dairymen in the eastern part of the State who buy most of their cows. It is a fact, however, that in New England, and especially in Massachusetts, where such inspections have been practiced on the largest scale and for the longest time, the price of cattle has not been noticeably increased. Even if there were a slight increase in price, is not the additional security worth an advance of one per cent. on the cost of the cow? However, to do away with this objection, I believe that it would pay, under certain restrictions and conditions, to make inspections of cattle belonging to dealers, upon application from them and without cost to them. The animals found to be free from disease could then be sold with a guarantee as to their condition and owners of sound herds could buy without danger of infecting them. Those that proved to be tuberculous could be disposed of as other tuberculous cattle are disposed of now—by appraisement and destruction. Such action would prevent the spread of much disease.

In reference to other diseases, I would say that my services have been demanded in connection with the following affections, Texas fever, glanders, rabies, hog cholera, osteoporosis, tuberculosis, infectious abortion, black leg, anthrax, fowl cholera, periodic-ophthalmia, red water, strangles, distemper of dogs, garget, influenza and many other diseases that do not properly come within the sphere of public action, because not transmissible. These diseases have involved all species of domestic animals and all parts of the State.

Information and advice have been furnished in letters to more than five thousand correspondents and numerous personal visits and inspections have been made for the purpose of ascertaining the condition of live stock.

The Bacteriologist, Dr. M. P. Ravenel, has been engaged in making mallein, tuberculin and anthrax vaccine, in examining numerous specimens from animals suffering with various diseases that were sent in for identification from all sections of the State, and in conducting much of the original work of the Board.

A special report on tuberculosis is now in preparation, which it is hoped to publish as a bulletin later in the year. Articles on abortion of cattle and on hog cholera are to be found among the papers in another part of this volume, and I attach hereto some facts of current interest regarding some of the diseases that have received special attention during the past year

Rabies.

In my last annual report I devoted considerable space to a discussion of this affection on account of the great prevalence of the disease during last year and the misunderstanding that so generally exists in reference to it. During the present year, a large number of reports of rabies have been received and considerable work has fallen upon the State Live Stock Sanitary Board in connection with this disease.

There are still a few people who profess to believe that there is no such disease as rabies, or hydrophobia, and lengthy articles have been written and published widely in which it is claimed that all so-called cases of rabies are either myths or some other disease, the nature of which has not been recognized. Such articles and statements have done a great deal of harm, because they render it difficult to carry out the measures that it is necessary to enforce in order to suppress this dreadful malady. It is sufficiently easy to disprove such allegations if their authors are known and will consent to consider the scientific facts that have been demonstrated in connection with this question. But many of these statements are published anonymously, and while they contain no scientific facts to substantiate them they nevertheless tend to unsettle public opinion, with the result above mentioned.

Has it ever occurred to those who really profess to believe that there is no such disease as rabies that the history of this affection dates from the earliest medical literature? It is, in fact, one of the oldest diseases of which there is an authentic record and was described by Aristotle about 400 B. C., who stated, "The dogs suffered from rabies. This throws them into a condition of fury and all animals which they then bite develop rabies."

This disease in man has also been described by the earliest of the ancient physicians and reports of outbreaks occur repeatedly in medical literature from that time to the present. Eminent scientists, and Government commissions without number, have studied rabies and have, in all cases, arrived at the conclusion that it is an extremely dangerous malady, transmitted by the bite of an animal afflicted with it. Contrary views are held by a few individuals who have not had the facilities, inclination or skill necessary to enable them to study this disease scientifically and experimentally.

One of the principal advocates of the view that rabies does not exist bases his opinion largely upon the results of some investigations made by him of newspaper reports of this disease, and he has found that in many instances where it was claimed that dogs were mad no evil results followed their bites, and some people who were claimed to have rabies were, he states, actually suffering from some other disease. It is undeniably true that a great many of the public reports of rabies are wrong and based upon a misinterpretation or exaggeration of certain comparatively harmless conditions in dogs, but it is also undeniably

true that many other diseases have been wrongly diagnosed. Because a certain horse suffering with a discharge from the nose is not afflicted with glanders, it is no indication that glanders does not exist and that another horse suffering with a discharge from the nose may not have this deadly disease. Any one, no matter how prejudiced he may be, who will honestly study the real facts, will be convinced that there is a widespread and altogether too common disease of dogs that is generally characterized by a tendency to roam, by a marked alteration of temperament and voice, frequently by a furious and uncontrollable desire to bite, sometimes by paralysis of the jaw and throat and always terminating in death. A comparatively superficial study of the facts will also show that this disease can be conveyed to healthy animals by the bite of an animal suffering with it, and that the inoculation of animals with saliva or with portions of the brain or spinal cord, taken from the subjects of such disease, will reproduce it, that it can be transmitted indefinitely from animal to animal and that instead of losing strength and virulence by such transmission, it is usually rendered more malignant. It is utterly absurd and foolish to deny that such a disease exists, and if this disease is not rabies it remains for those who deny the existence of rabies to supply another name for it.

Reports on rabies occur in the official health publications of all the Governments of Europe, and the disease is recognized as an exceedingly dangerous one, to be combated most energetically. It was formerly supposed that rabies would develop spontaneously as the result of certain unfavorable conditions, such as confinement, thirst, nervous excitement, stimulant, diet, etc., but it is now demonstrated beyond question that such is not the case, and that the only cause of the disease is direct inoculation from a rabid animal, usually by biting.

On the 23d of March of this year, the British Board of Agriculture issued a far reaching order in reference to this disease, which was deemed necessary on account of the fact that rabies has been increasing for the last few years, and it was thought wise to make an energetic attempt to get rid of it. By this order it was provided that all dogs of Great Britain shall be muzzled, that all animals affected with or suspected of rabies shall be at once reported to the police authorities, and that such information shall be transmitted without delay to the Board of Agriculture. All dogs diseased or which had been bitten by a diseased or suspected dog, are killed. All strange dogs are seized and detained and the importation of dogs from foreign countries is prohibited, excepting when made in accordance with the most stringent provisions. As a result of these new regulations, rabies is rapidly becoming less prevalent, and it is hoped that the disease will be exterminated in England within a comparatively short time. Similar regulations have succeeded in practically eradicating rabies in Ger-

many and in completely extinguishing it in Norway and Sweden, and the future introduction of the disease is prevented by the regulations governing the importation of animals.

On account of the great prevalence of rabies in Columbia and Montour counties last year, and the fact that the appearance of one or two cases led to fear that there would be a repetition of the losses and danger of the previous year, the following regulation was made by the State Live Stock Sanitary Board on June 15, 1897, and posted in numerous places throughout these counties:

"*Whereas*, There is reason to believe that the disease known as rabies, or hydrophobia, exists in the vicinity of Catawissa, and the nature of this disease is such that for the present all dogs, within certain limits, must be suspected of being capable of spreading it, be it

Resolved, By the State Live Stock Sanitary Board, by the authority conferred by the act of May 21, 1895, that all dogs in the counties of Columbia and Montour are hereby declared to be in a state of quarantine, and must be strictly confined or firmly secured on the premises of their owners, and not allowed to run at large or enter public highways, excepting when led or when muzzled with a well fitting muzzle that will affectually prevent biting. This quarantine shall remain in force for 90 days or until removed by the State Live Stock Sanitary Board."

Although the regulation was disregarded in some cases, it was quite generally observed and no cases of rabies, *except in muzzled or confined dogs, which were promptly destroyed*, were reported from either of these counties after the regulation went into effect.

During the past year I have been appealed to by more than one hundred individuals in different parts of the State for advice or action concerning rabies among the different species of domestic animals. To avoid danger, it has been necessary to destroy a number of dogs, cattle, horses and sheep.

As illustrating the symptoms presented by animals suffering with rabies as it has occurred in Pennsylvania, I quote as follows from a letter from a gentleman at Mount Carmel, Pa., who had a very valuable horse taken with what the veterinarian called hydrophobia on January 7, 1897. His first symptoms were pawing, with occasional straining and elevation of the tail. It was thought that he had colic and he was treated for it, but he soon developed other symptoms that led to a change in diagnosis. He became vicious, would lay back his ears and would try to bite the horse in the next stall and repeat this act every few moments. In order to warm him up he was ridden around the town during which it was noticed that he was unusually skittish and nervous. About twenty minutes after his return to the stable he showed more violent symptoms, parted his lips, put back his ears and would jump at any horse or man. At this

time it was thought that he had "fits or staggers," but as he became more vicious it was evident that this was not the trouble. He would strike and bite at anything that came before him; not aimlessly, but apparently with intention to do harm. At this time he breathed very hard, frothed at the mouth and, the owner said, panted like a dog. His eyes protruded and were red. His every appearance was that of an infuriated wild beast and no one dared to venture near. He would jump over the manger, bite, kick and plunge. Fearing that he would escape from the stable, he was shot. The horse had been worked every day and up to the time of the beginning of his illness. Although it was not known that he had been bitten by a mad dog, several had been killed a short time before in that neighborhood. The diagnosis was not confirmed by experimental inoculation.

In April, hydrophobia appeared in a flock of sheep at White Haven, Pa. These sheep were bitten by a strange dog that appeared in the neighborhood on the 7th of April. This dog bit several people, who were promptly treated; seven dogs and seven sheep. Up to date, none of the people who were bitten have developed any disquieting symptoms. Four of the dogs that were bitten went mad before the end of April and were shot and the other three were shot as soon as bitten. Of the sheep, two became exceedingly nervous on Saturday, the 24th of April. It was noticed that they seemed at first restless, alarmed and excitable. Afterwards, they would bite fences and trees and subsequently became vicious and would attack one another. Twenty-four hours after the onset of the disease they were so violent that when a stick was held toward them by a man standing on the other side of the fence, they would rush at it and grasp it in their mouths. The other sheep in the flock became similarly affected until all had died, after passing through the same experience, at periods of from two to four days after the beginning of the attack. The dogs referred to were all killed before they did any damage.

Several cattle were bitten by rabid dogs and developed rabies in the counties of Cumberland, Adams and Huntingdon. In some of these cases the brains from the animals were subjected to laboratory study, and it was demonstrated beyond question that they actually suffered with rabies. I have in my possession reports from nineteen veterinarians in different parts of Pennsylvania in which rabies is described among more than 200 dogs. These reports came from all portions of the State and indicate that this disease is of wider distribution and greater prevalence than has previously been suspected and indicate the urgent necessity of vigilance on the part of all owners of live stock.

The measures that are to be recommended to prevent the dissimination of rabies are the following:

1. All strange dogs should be shot or securely confined, especially if they have the appearance of having traveled a long distance, by showing signs of fatigue, are foot-sore, covered with mud or if they show a sullen disposition, or if the mouth hangs wide open, with the tongue out and covered with dust and the animal is evidently unable to close it, or if the dog shows a disposition to bite.

2. When rabies is known to prevail in a district, the above precautions should be observed with special care, and dogs should not be allowed to run at large excepting under the eyes of their masters.

3. If a dog or other animal has been bitten by a dog that is known to have rabies it should at once be killed.

4. If the biting dog is not known to have rabies, but is suspected of having it, he should be confined, well cared for and kept under observation for a few days. If he has rabies, the disease will develop during this period so that it can be recognized, and if he does not have rabies he can be released as soon as the fact is ascertained. If the biting dog is shot, a post-mortem examination should be held by a veterinarian and, if necessary, experimental inoculations should be made for the purpose of ascertaining whether he was a victim of rabies. If it is ascertained that he was so affected, the animals bitten by him should be killed and, in any case, they should be kept in confinement until positive information on this point is obtained.*

Glanders.

This very dangerous and much-dreaded disease of horses and mules is becoming rarer each year. During the past twelve months, cases have been discovered and killed in the following counties: Allegheny, Beaver, Bedford, Berks, Bucks, Elk, Lackawanna, Lycoming, Montgomery and Philadelphia. Altogether, 21 cases have been disposed of. Four cases, found in three different counties, were traced to a single car load of horses from Nebraska that were sold at auction in a small town near Philadelphia.

Glanders is a contagious disease confined principally to animals of the equine species, but transmissible from them to dogs, cats and man. In every case that I have met with, in which the source of the disease could be ascertained, it was traced to a glandered horse or mule. It was at one time thought that glanders could arise spontaneously, as a result of keeping horses under unhygienic conditions and cases were cited which showed that animals thus kept were frequently exten-

*If the facilities are not at hand for making a thorough examination of a suspected rabid dog that has been shot, the brain will be examined without cost if sent to the Laboratory of the State Live Stock Sanitary Board, 3608 Pine street, Philadelphia. When the brain is submitted for this purpose the head of the animal should be cut off, wrapped in rubber cloth or placed in a water-tight vessel with ice outside, this placed in another water-tight bucket, well covered, and expressed at once. A letter should always accompany such shipments, giving the facts of the case in full.

sively diseased. The keeping of horses in dark, badly ventilated, cellar stables was supposed to be one of the prominent causes of this disease. It was also thought that strangles or colt distemper could develop into this more dangerous and malignant malady. We now know, however, and have the most indisputable proof to show, that glanders cannot develop unless an animal is exposed to the specific germs of this disease. These germs may pass directly from a diseased animal to one that is healthy or their transmission may be indirect; they may be deposited on managers, feed boxes, stall partitions or watering-troughs and thence pass into healthy animals, producing glanders. The period that elapses between the entrance of the germ and the development of the first signs of the disease, known as the period of incubation, is quite variable. It is as short as ten days in some cases, while in others it may be prolonged to several months. The length of this period depends upon the point at which the disease starts and upon its activity. The activity of the disease depends upon the number of germs that are introduced and upon their virulence. Just as some seeds develop into imperfect and unthrifty plants and others into plants that are strong and rugged, some germs of disease have less vitality and strength than others and their effects are not so marked as in the case of germs that are more virulent and strong. The rapidity with which a disease develops depends, also, to some extent upon the condition of its subject.

When the germs of glanders pass deeply into the respiratory tract of a horse, that is, into the back of the nasal passages, the throat, bronchial tubes or lungs and do not lodge in the vicinity of the nostrils, the characteristic changes produced by these organisms are not visible, and this explains the fact that horses sometimes suffer from glanders for a considerable period, and spread the germs of the disease, infecting other horses, before their dangerous condition is recognized.

There was a time, during and following the late war, when glanders was an exceedingly common disease, so common that no horse owner could feel secure, and many valuable animals contracted it and died or had to be killed, even those kept under what seemed to be the most favorable condition.

If all glandered horses were killed and the places occupied by them were disinfected, the disease would become extinct and could never reappear, just as surely as oak trees would become extinct if all acorns were destroyed and just as surely as contagious pleuro-pneumonia of cattle has been exterminated in this country by the destruction of all cattle afflicted with this disease. Ten years ago, contagious pleuro-pneumonia prevailed in several states and there were many who did not hesitate to say that the disease could never be exterminated in America, but results have shown that the disease has been exterm-

inated and not a single case has been found in the United States during the past six years. We are approaching a similar condition in reference to glanders, and I do not hesitate to say that before many years have passed glanders will have been extinguished in the United States. This desirable result will be effected through the continued vigilance of veterinarians and the authorities charged with the control of the diseases of animals in the various parts of the Union.

In suppressing glanders, great assistance is derived from the use of mallein in diagnosing difficult cases. The symptoms of glanders are not always so prominent and characteristic that the disease can be recognized quickly and accurately. It is sometimes difficult to distinguish between cases of glanders and catarrhal conditions of various kinds. In such cases, the doubt can usually be cleared up by the use of mallein.

Mallein is a fluid made from cultures of glanders and is used for the purpose of ascertaining whether horses suffer with glanders or not. The application of mallein, for this purpose, constitutes the mallein test. In performing the test, a small quantity of mallein is injected beneath the skin of the suspected horse. If the animal has glanders, there results a rise of temperature and a local swelling at the point of infection; whereas, if the animal does not suffer with glanders these results were not obtained. While the mallein test is not infallible, its accuracy is quite remarkable and its results, taken in connection with the physical symptoms, usually make it possible to render an accurate diagnosis, without delay.

Whenever glanders is reported in any part of Pennsylvania the matter is investigated at once, and if the report proves to be true the glandered animals are appraised and destroyed and the premises occupied by them are thoroughly disinfected. Glanders is far more common in many states than it is in Pennsylvania, but the dangerous character of the disease is so generally recognized that there is an almost universal disposition to deal with cases of it in the only way that experience has shown to be effectual. More benefit may be expected from the further distribution of information respecting this disease, so that horse owners may be able to guard against it and know that it is necessary to sacrifice its victims, wherever it appears.

It is fortnuate that all horses, as well as other animals, coming into the United States from abroad are quarantined and carefully inspected by agents of the United States Bureau of Animal Industry. This prevents contamination from without and as the states suppress the ground that has been gained. The results that have been glanders they are not in danger of losing, from outside contamination, achieved in connection with the suppression of glanders and contagious pleuro-pneumonia and other diseases, should encourage us in our contest with tuberculosis of cattle, cholera of hogs and many

other destructive maladies. While the same methods will not be successful in all cases, the appropriate treatments can be found and, when applied, the results, undoubtedly, will be as gratifying.

Hog Cholera.

This disease has not prevailed so extensively this year as last, but still it has been met with in seventeen counties. Hog cholera outbreaks usually result from the introduction of western hogs that were exposed to the germs of this disease on the farms from whence they come, in the stock yards or in the cars. They often present no symptoms of disease until they are established on the farm of the buyer in this State, when their incipient malady develops, other hogs contract it and an outbreak is started. These occurences develop all through the year, except in winter when they are checked by the cold weather. If an outbreak starts in the spring contagion has opportunity to spread long distances, hence early outbreaks are most disastrous.

When hog cholera appears, the watch words are, isolation and disinfection. In addition, however, the carcasses of the dead animals must be disposed of by deep burial or burning.

At present, the Bureau of Animal Industry has some investigations in progress, through which it is hoped that more effectual means of prevention may be developed. Experiments are also being made with a vaccine to be used in preventing hog cholera. A further discussion of this subject will be found in another part of this volume.

Abnormal (Depraved) Appetite of Cattle.

The disease of cattle that is characterized by a desire to eat abnormal things—things foreign to their normal diet—is one that has received but little attention in this country. In some European countries, on the other hand, this disease has received much study. These facts are accounted for by the comparative rarity in the United States of districts in which this disease exists.

There are but few places in Pennsylvania in which depraved appetite of cattle has been met with and in each the trouble seemed to be of recent origin.

It is a common thing for cattle to lick cold substances or those that have a peculiar taste, and to eat straw in horse manure, and sometimes, especially when there is some slight derangement of digestion, they may show a temporary preference for things apart from their normal food. It is only when these symptoms are pronounced and of long standing and are accompanied by marked loss of condition that this state constitutes a disease. In such cases, the preference for abnormal substances, as manure, coarse fodder, rotten wood, leather, paper, mouldy or decayed hay, grass, etc., is very marked, and to the partial or complete exclusion of other food.

The disease is of slow development and in addition to the characteristic symptom that gives it its name, there is loss of flesh, dry skin, harsh coat, tenderness to pressure along the back, loss of strength and diminished milk production. This affection has been ascribed to various causes, but it is now generally believed to be due largely to some deficiency in the food, and this view is supported by the observation that it is most prevalent on old exhausted farms and in marshy districts where the vegitation is characterized by rank, too luxuriant growth.

For a long time, the treatment of this disease was attended by little success and most of the cases became steadily worse, the animal loosing weight and strength until completely worn out. At present, however, thanks to a German veterinarian there is a remedy at hand by means of which this disease can be successfully treated. It has been shown by Feser and Leurke that apomorphine in doses of from one and one-half to three grains administered sub-cutaneously, each day for three or four days, and a complete change of diet, will effect a cure. This treatment can be carried out very easily and is of great value.

Black Leg.

Black leg, or black quarter, is an infectious disease that is usually rapidly fatal and to which young cattle seem to be predisposed. This disease has been met with in several parts of Pennsylvania during the past year and its distribution is characterized by the same features that have been noted by nearly all of those who have described it elsewhere. Low lands and mountain valleys are the favorite localities for its occurrence and it prevails more frequently on new lands than on farms that have been under cultivation for a long time.

Black leg is caused by a germ which forms a spore that is almost as resistent as that of anthrax. It will endure drying for several years and still retain sufficient vitality to produce disease in animals inoculated with it. It remains alive and virulent in buried carcasses for six months. This germ, or its spore, produces disease when it enters an abraide surface, either of the skin or the membrane of the mouth or throat. No harm results from the mere swallowing of food or water containing the germ if the surfaces over which these substances pass are intact. But as slight abrasions occur so readily and are so obscure, the fact that such an entrance is necessary for the germ is not of high practical importance. In most cases, the entrance is through a slight wound on one of the extremities. The germ from the soil or vegetation passes through this opening and grows beneath the skin and in from one to three days a great, soft swelling is produced. This swelling, which may appear on any part of the body, crackles peculiarly when stroked or pressed. There is high temperature, depres-

sion, loss of appetite and, usually, death occurs in from one to three days after the beginning of the attack.

After death it will be found that the tissue beneath the skin covering the swelling is filled with a mass of yellow or reddish gelatinous material which contains many bubbles of gas. The sub-adjacent muscles are dark red and friable. As distinguishing this disease from anthrax it is important to note that the blood clots and is normal in appearance and the spleen is unchanged.

The treatment for black leg is of little value because the development of the disease is so violent and rapid. It is not quite so severe, however, in cattle over three years of age as in those between the ages of three months and three years, and in aged animals recovery sometimes takes place. If treatment is employed, it should consist in deep scarification and energetic disinfection. But in this case, as in others where disease is under consideration, prevention is far better than cure, and we are fortunate in possessing a vaccine that affords a high degree of security from the attacks of this malady. This vaccine is made in the laboratory by reducing the virulence of the germ, by accurately graduated heat, to such an extent that when introduced beneath the skin of an animal the disease is produced in a mild form, not severe enough to do harm but still sufficient to confer immunity from future attacks.

In some countries, as in Switzerland, where black leg is very prevalent, this vaccination is of the highest value to the live stock interests. In fact it is essential in many districts to its continuation and a large proportion of all young cattle are protected each year.

Vaccination has been practised on a few infected farms in Pennsylvania during the past year and with very encouraging results. No injury has resulted from the treatment and no cases have, thus far, developed among the animals protected. The vaccine for this purpose was obtained from the Bureau of Animal Industry, of the Department of Agriculture, in Washington, where it was prepared under the direction of Dr. D. E. Salmon.

In addition to vaccination, the general precautions recommended in reference to anthrax should be observed.

TUBERCULOSIS.

Inspections of herds have been made upon owner's request in all sections of the State. It has been found that this disease is far more extensive in some places than others, and its prevalence appears to be in direct ratio to the activity of traffic in dairy cows and the age of the dairy industry. Where trade in cows is active, it naturally results that more tuberculous animals are brought into a district than where cattle sales are less common. That is, in two districts there may be, approximately, an equal number of cattle, but different

systems of supplying additions to herds. Tuberculosis is apt to be more prevalent in the locality in which the cows that are used are purchased and brought in from a distance than in the one in which it is the practice of the farmers to rear their own cows. Where the trade in cattle is outward, there is very little tuberculosis; where the principal trade in cattle is inward, there is much tuberculosis, and there is, therefore, more tuberculosis in the old dairy districts than in regions where general farming is practised or where modern dairying is of recent development. This observation is not new and it has been held by some that the conditions are explained by the pressure to which dairy cows are subjected under modern dairy systems, but my observations do not confirm this opinion. I believe that tuberculosis is more prevalent in the localities mentioned for the reason that more tuberculous cattle are brought in and greater facilities are afforded for the distribution of the disease by contact with them, whereas, under the other conditions there is little tuberculosis because it is not introduced from without and cattle trade is so sluggish that it has not been spread rapidly by local tuberculous animals.

That dairies may be conducted on the, so-called, high-pressure plan without detriment to the cows composing them has been demonstrated so frequently that further proof is unnecessary, and that herds may be extensively diseased with tuberculous when they are kept under what are popularly called natural conditions and old-fashioned methods is a matter of every-day observation.

The fact cannot be too strongly impressed that tuberculosis exists in herds because it is introduced from without, and if herds are protected from outside contamination they will not develop tuberculosis on account of any system under which they are kept, or the work that they are required to do, and I know of no case in which there is any reason to believe that a herd became infected with tuberculosis from any other cause than exposure to one or more tuberculous animals or their products. On the other hand, it is true that certain conditions predispose to the development of tuberculosis and lead to its more rapid distribution when it is once introduced. These conditions may be designated predisposing or accessory causes and under this head are classed unhygenic surroundings, improper feeding and breeding, overwork, improper confinement or exposure, etc.

In dealing with tuberculosis of cattle, the plan described in last years' annual report has been contined. Herd inspections are made whenever herd owners apply for them and furnish good reasons for the belief that tuberculosis exists among their cattle. The number of inspections made under these conditions has been limited only by our available resources.

The marked reduction of the percentage of tuberculosis among inspected herds is referred to in the preliminary part of this report.

The most extensive series of inspections have been made in Bradford and Susquehanna counties.

In these counties 4,606 cattle have been tested with tuberculin and 418 tuberculous cattle have been appraised and destroyed. Several very seriously infected herds were found here, but were effectually disposed of and nearly all of the recent inspections have shown a remarkable freedom from tuberculosis. There are many districts in these counties in which no tuberculosis whatever has been discovered, and I believe that at present the Bradford and Susquehanna Co. cattle are free from tuberculosis to a very exceptional degree. The work that has been done in these counties forcibly illustrates the effect of these inspections. Many of the herds that were examined were recently infected, as shown by the history and the fact that but one or two tuberculous cattle were found. The source of contamination could be traced in a large percentage of cases to the introduction of animals that it was afterwards discovered were victims of tuberculosis. The effect of the inspections in these two counties has been not only to destroy 418 cattle than could act as carriers of the disease, but they have also aroused public interest in this question and have placed farmers on their guard, who are now prepared to meet the enemy, for they will be able to recognize it and are acquainted with its tactics. If these inspections had not been made, tuberculosis would have continued in its course and before long these two counties would have been as badly infected as the most seriously diseased centers in the Commonwealth. The business of these counties depends upon the cow to such a great extent that the importance of keeping the herds free from tuberculosis can scarcely be overestimated, a factor that has done much to encourage the inspection of herds. I regret that it has not been possible to comply with all of the requests for herd inspections that have reached us but, as in all other portions of the State, it has been necessary to restrict the examinations to herds that there was good reason to believe were infected with tuberculosis.

All of the tuberculin that has been used for our inspections during the past year has been made by Mr. M. P. Ravenel in the laboratory of the State Live Stock Sanitary Board. It has been, in all respects, as satisfactory as that made anywhere else and results obtained from its use have been remarkable for their accuracy. The 2,510 cows that have been killed have all been examined post mortem. In all cases in which animals were condemned by the use of tuberculin they were found, by this examination, to be affected with tuberculosis, with the exception of one cow killed by one of the agents before the beginning of the year of this report, and in this case the reaction was not characteristic. While one aspect of the accuracy of tuberculin can be subjected

to a final test in this way, there is another phase of its action in regard to which our knowledge is less exact. How many cattle that are actually tuberculous fail to respond to the tuberculin test and show no symptoms of disease and, therefore, remain undiscovered? As there is no opportunity for a post mortem examination of cows that are not condemned, excepting on the rare occasion when it is possible to see them opened by the butcher or to examine them after they have died of injury or other disease, statistics on this side of the question are quite meagre. In some cases a retest of a previously inspected herd has shown a few animals with tuberculosis. Whether these cattle were not detected by the first examination or whether they contracted the disease subsequent thereto must remain an open question, but there is, doubtless, a small percentage of tuberculous cattle that fail to respond to the tuberculin test. Most of these animals do not respond because the disease is so advanced and the animals are so debilitated that their vital powers are reduced and their functions are sluggish. These cases can be detected by physical examination, and as they are thus detected and removed from the herd they do not vitiate the result of the work. The few remaining cases that cannot be detected either by physical examination or tuberculin test are usually of the latent form and therefore not dangerous at the time of examination.

A few years ago tuberculin was objected to by those who had no experience with it on the ground that it might injure healthy cattle. But experience covering thousands of cases, extending over years of time, show that this view is groundless and with the very large number of animals examined with tuberculin in Pennsylvania, *there has not been a report of a single case in which it was even suspected that the test had caused the slightest injury.*

The development of methods to be employed in dealing with this disease will be progressive and it will be our constant endeavor to discover new and more efficient measures that may be employed with advantage and economy.

In this connection, the provisions of the act of June 20, 1897, are being availed of and an extensive series of experiments is planned and under way for the purpose of throwing additional light on some of the obscure features of the tuberculosis question.

It is to be our especial aim to gather facts bearing on the influence of sanitary conditions on the distribution of tuberculosis and predisposition to it; the infectiousness of milk under special known conditions; the influence of light on the germ and its growth in the animal and the value of treatment with tuberculin or other agents.

Infectious Abortion of Cattle.

As an extensive article on this disease appears in another part of this report, it is unnecessary to discuss it in detail here. Numerous

outbreaks of infectious abortion have been met with during the past year, and it is evident that enormus losses result to dairymen from the prevalence of this disease.

A full description of its cause and the means to be employed, in the light of our present knowledge, to prevent it are given elsewhere, and it only remains to emphasize the fact that this is a contagious disease and the directions given as to isolation and disinfection can not be followed too rigidly.

Catarrhal or Broncho-Pneumonia of Cattle.*

The study of this disease, commenced last year, has been continued and it has been seen in several herds during the autumn. On October 16, Mr. ———, of Huntingdon county, applied for an inspection of his herd and expressed the belief that his cattle were afflicted with tuberculosis. It seems that he had purchased seven yearlings in Centre county that appeared healthy when they were bought, but shortly after they reached his farm they developed a severe cough, lost condition, became emaciated and four died. Subsquently, some other young cattle on his farm developed similar symptoms, leading to the belief that the affection was contagious and tuberculosis was suspected. The herd, consisting of seventeen animals, was tested with tuberculin by Dr. Louis A. Klein, of Lewistown, on November 1, with the following result:

* Through an error in copying, a reference was made in my report of last year to Croupous Pneumonia of Cattle, whereas Catarrhal Pneumonia was intended.

No.	Description.	Age.	Temperatures Before Injection. Date: November 1, 1897.			Date: November 1, 1897.		Temperatures After Injection. Date: November 2, 1897.					
			Time: 4 p. m.	Time: 6 p. m.	Time: 8 p. m.	Dose of tuberculin solution.	Time of injection.	Time: 6 a. m.	Time: 9 a. m.	Time: 11 a. m.	Time: 1 p. m.	Time: 3 p. m.	Time: 4 p. m.
1	Grade cow,	9,	101.9	101.6	101.8	dr. i.,	9 p. m.,	101.6	101.6	101.5	101	....	....
2	Grade cow,	4,	101.8	102.1	102.2	"	9 p. m.,	102.2	101.7	101.5	102.1	101.8	....
3	Jersey cow,	7,	102.1	101.6	101.2	"	9 p. m.,	101.1	101.4	101.4	101.4	101.3	....
4	Grade cow,	5,	102.4	101.7	101.8	"	9 p. m.,	101.5	101.7	101.8	101.5	101.5	....
5	Grade cow,	3,	102.3	101.9	101.8	"	9 p. m.,	101.2	101.6	101.3	101.2	101.1	....
6	Grade cow,	7,	102.1	102.2	101.7	"	9 p. m.,	102.2	102	101.7	101.6	101.7	101.3
7	Grade steer,	1½,	102.2	102.3	103.2	"	9 p. m.,	101.6	101.2	101.8	101.8	101.6	101.8
8	Grade steer,	1½,	102	102.2	102.5	"	9 p. m.,	101.7	101.2	102	101.4	101.3	....
9	Grade bull,	2½,	101.2	102	100.4	"	9 p. m.,	102.3	101.7	101.6	101.3	....	....
10	Grade heifer,	2,	102.6	102.6	102.4	"	9 p. m.,	101.4	101.5	101.5	101.5	101.3	....
11	Bull calf,	8 mos.,	102	101.8	101.6	m. xl.,	9 p. m.,	101.2	101.2	101.5	101.2	102	101.9
12	Bull calf,	6 mos.,	103.7	102.8	102.7	m. xl.,	9 p. m.,	102.2	102.8	101.4	101.5	102.4	102.4
13	Heifer calf,	8 mos.,	103.7	103.1	102.5	m. xl.,	9 p. m.,	102.4	102.9	102.3	102	102.4	102.4
14	Heifer calf,	4 mos.,	103.5	102.6	102.4	m. xl.,	9 p. m.,	102.2	102.5	102.4	102.4	102.6	102.3
15	Bull calf,	10 mos.,	103.3	102.6	102.8	m. xl.,	9 p. m.,	102.4	102.7	102.4	102.6	102.3	....
16	Bull calf,	7 mos.,	103.3	103.4	102.5	m. xl.,	9 p. m.,	102.4	102.1	102.6	101.9	102.3	102.2
17	Heifer calf,	7 mos.,	103.1	102.4	102.8	m. xl.,	9 p. m.,	102.1	102.3	102.5	102.2	102.4	102.6

It will be noticed that there is no indication of tuberculosis in any of the animals so far as the temperatures are concerned. The affection was, however, so indefinite that one of the heifers was purchased and killed, a careful post mortem examination being made. Some of the tissues were sent to the laboratory of the State Live Stock Sanitary Board for study. The examination of the lung showed that the anterior lobes of both of them were dark red in color, solidified and heavy and upon cross section there appeared numerous small cavities containing yellowish cheesy pus. The bronchial tubes contained frothy mucous and their lining membrane was thickened. The connective tissue stripes separating the lobules were infiltrated with serum and thickened. The pleura was smooth and quite normal. The lymphatic glands were normal and all of the other organs were normal in appearance, although somewhat pale.

On November 10 the herd belonging to Mr. ———, of Mifflin county, was tested by Dr. Klein, with the following result:

No.	Description.	Age.	Temperatures Before Injection. Date: November 10, 1897. Time: 3 p. m.	Time: 5.45 p. m.	Date: November 10. Dose of tuberculin solution.	Time of injection.	Temperatures After Injection. Date: November 11, 1897. Time: 4.30 a. m.	Time: 7.30 a. m.	Time: 10.30 a. m.	Time: 1 p. m.
1	Daisy Jersey Grade,	4,	102.5	102.2	•,	7.30 p. m.,	101.5	102	102.1	102.1
2	Holstein grade cow,	4,	101.7	101.4	•,	7.30 p. m.,	100.9	101.3	101.9	101.9
3	Holstein grade cow,	6,	101.1	101.4	•,	7.30 p. m.,	101	101.4	101.1	....
4	Jersey grade cow,	5,	101.6	101.7	•,	7.30 p. m.,	101.2	101.7	101.6	....
5	Grade heifer,	2,	101.7	101.6	•,	7.30 p. m.,	101	101.5	101.2	....
6	Grade heifer,	2,	101.5	101.4	•,	7.30 p. m.,	101.5	101.2	101.4	101.2
7	Holstein grade heife	2,	101.8	101.7	•,	7.30 p. m.,	101.1	101.7	101.9	101.9
8	Jersey heifer,	2,	101.2	101.2	•,	7.30 p. m.,	101.1	101.2	101.3	101.5
9	Grade heifer,	2,	102.6	102.5	•,	7.30 p. m.,	102.1	102.4	102.4	....
10	Holstein grade heifer,	2,	101.5	102.2	•,	7.30 p. m.,	102	102.2	101.8	....
11	Grade heifer,	2,	102.4	102.4	•,	7.30 p. m.,	101.8	102.3	101.9	....
12	Jersey grade heifer,	2,	101.4	102	•,	7.30 p. m.,	102.1	101.7	101.8	102
13	Holstein grade bull,	2,	103.2	103.5	•,	7.30 p. m.,	102.4	102.4	102.5	102.3
14	Grade heifer,	1½,	101.5	101.7	•,	7.30 p. m.,	101.6	101.9	101.7	....
15	Jersey grade heifer,	2,	102.2	102.2	•,	7.30 p. m.,	101.8	102.3	101.7	....
16	Grade heifer,	2,	101.8	101.6	•,	7.30 p. m.,	101.5	102	101.8	....
17	Heifer calf, grade,	3 mos.	102	102.4	m. xl.,	7.30 p. m.,	101.9	102.6	103.4	....
18	Heifer calf, grade,	3 mos.	102.4	102.9	m. xl.,	7.30 p. m.,	101.9	102	102.1	102.7
19	Grade steer,	2,	101.1	101.6	•,	7.30 p. m.,	99.1	100.4	100.6	100.6
20	Grade steer,	2,	101.4	101.4	•,	7.30 p. m.,	101.6	101.8	101.6	101.9
21	Grade bull,	2,	101.8	102.2	•,	7.30 p. m.,	101	99.3	99.1	....
22	Grade steer,	2,	101	101	•,	7.30 p. m.,	100.4	101.8	100.9	....
23	Grade heifer,	2,	101.8	102.1	•,	7.30 p. m.,	101.7	101.8	101.8	101.6
24	Grade heifer	2,	101.8	101.2	•,	7.30 p. m.,	101	101.5	101.9	101.5
25	Holstein grade steer,	2,	102	102.2	•,	7.30 p. m.,	100.4	101.4	101.4	....
26	Grade heifer,	1½,	101.9	101.8	•,	7.30 p. m.,	102	101.5	101.7	101.4
27	Grade steer,	10 mos.	101.7	100.5	m. l.,	7.30 p. m.,	102.2	101.1	101.3	102.1
28	Grade steer,	10 mos.	102.8	101.4	m. l.,	7.30 p. m.,	101.1	101.8	102.5	102.5
29	Grade steer,	10 mos.	102.6	101.2	m. l.,	7.30 p. m.,	101.9	101.5	101.6	101.7
30	Grade steer,	10 mos.	102.1	101.8	m. l.,	7.30 p. m.,	101.1	102.3	102.4	102.2

31	Grade heifer,	10 mos.,	102.2	102.2	m. l.,	7.30 p. m.,	101.8	100.3	102.3	102.5
32	Grade heifer,	10 mos.,	102	101.9	m. l.,	7.30 p. m.,	101.7	102.6	102.5	
33	Grade bull,	10 mos.,	102.1	102.4	m. l.,	7.30 p. m.,	102.2	102.2	102.1	
34	Grade bull,	10 mos.,	101.7	101.8	m. l.,	7.30 p. m.,	102.4	102	102.2	102.2
35	Grade steer,	14 mos.,	102.1	102.1	m. lv.,	7.30 p. m.,	101.7	102.2	102.7	102.2
36	Grade steer,	10 mos.,	101.2	100.9	m. l.,	7.30 p. m.,	101.1	102.5	102.2	102.2
37	Grade heifer,	8 mos.,	101.9	101.9	m. xlv.,	7.30 p. m.,	101.3	101.6	101.8	101.6
38	Grade steer,	15 mos.,	101.4	102.2	m. lv.,	7.30 p. m.,	101.9	102.5	102.8	102.8
39	Grade steer,	10 mos.,	101.7	101.9	m. l.,	7.30 p. m.,	101.9	102.3	102.9	101.3
40	Grade bull,	10 mos.,	101.6	100.8	m. l.,	7.30 p. m.,	101.7	100.6	101.6	100.6
41	Grade heifer,	10 mos.,	102.4	102.6	m. l.,	7.30 p. m.,	101.5	102.1	102.1	
42	Grade heifer,	8 mos.,	101.6	101.4	m. xlv.,	7.30 p. m.,	101.9	100.5	102.5	102.5
43	Grade bull,	10 mos.,	102.1	101.8	m. l.,	7.30 p. m.,	101.2	100.8	101.6	102.2
44	Holstein grade cow,	6,	101.4	100.9	•,	7.30 p. m.,	101.1	101.2	101.6	101.6

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indicating that none of the cattle were tuberculous. A history of the herd showed that one of the cows had been coughing for about two years and had recently been falling off in condition, although her appetite had continued good. About three months before the examination the cow standing next to her in the stable, and about a month later, the next two developed the same symptoms. At the time of the test, most of the cattle had the same cough, but with few exceptions had not lost condition. For the sake of ascertaining further the character of the disease, one of the cows was purchased from Mr. ——— and destroyed. The post mortem examination revealed red and solid areas in the posterior part of the cephalic lobe, nearly all of the middle lobe and the anterior part of the caudal lobe in each lung. A cross section revealed interlobular infiltration of serum and small areas of caseation and froth in the tubes. One cow from this herd that had been coughing for two months was subsequently killed for beef and a similar condition was found to exist in her lungs.

The owner of the herd was of the opinion that the cow first killed was the source of all the trouble in this herd. He said that the young cattle had not begun to cough until after she had been among them, and that the cattle in the neighborhood which seemed to be affected in the same way were in herds with which this cow came in contact. The people in the vicinity of these herds were alarmed lest their cattle should become infected with the same disease, and in some cases asked for the appraisal and destruction of the affected cattle as has been done in outbreaks of pleuro-pneumonia and tuberculosis, but as it was not clear whether the difficulty arose from local causes or whether it was actually spread by contact with diseased animals, the precaution was taken to advise the careful isolation of the diseased animals until this question could be decided. In December two calves were purchased from Mr. X, and at this time a careful study is in progress with a view of solving this question. Two healthy calves are being exposed in a way as will probably show whether the disease is contagious. Similar appearances of this disease have been reported elsewhere in the mountainous portions of the State.

A careful bacteriological examination was made in four cases by Dr. M. P. Ravanel, with negative results thus far. The lung tissues seemed to be quite sterile. Guinea pigs were inoculated with some of the morbid material from the lungs with no effect. This work excludes the two best known contagious diseases in which the lungs are involved, lung plague and consumption, but has not, as yet, revealed the cause of the present malady.

Although this disease was referred to in the last annual report, but little opportunity has occurred for the continuation of the study commenced a year ago, because no further accounts of its presence were received until about two months ago. It is confidently expected that

the present investigation will place us in a position to determine with accuracy the importance of this disease, and to formulate measures for meeting the new dangers that may accompany it. It has been recognized in several localities quite recently and the need of further information concerning it is becoming more apparent. This is being gathered rapidly.

ANTHRAX.

As anthrax has been met with in several widely separated portions of the Commonwealth during the past season and as the disease is a very virulent and dangerous one, I include herewith a brief description of it as a preliminary to a report on the outbreaks with which we have had to deal.

Anthrax is a disease of great antiquity and has at times caused enormous losses in European countries dating from the beginning of historic times to the present day. In some countries, it has on occasions almost exterminated the farm live stock. In other places, it prevails constantly to such an extent that until preventive vaccination was discovered by Pasteur the raising of live stock was an unprofitable occupation. The disease may occur in any of the warm blooded animals, but cattle and sheep are most susceptible to it, although during the past season several cases have been reported in Pennsylvania in horses, swine and men. Anthrax is caused by a bacillus which is found after death in great numbers in the blood, spleen, liver, and in fact, in practically all parts of the body. In most cases, this germ enters the animal from the soil; it reaches the soil from the body of an animal that has died of the disease. After the germ escapes from the body of an anthrax subject it developes a spore which is an enduring form of the germ and may be compared to the seed of a higher plant. This spore is characterized by its great and exceptional resistance to unfavorable conditions. It is not destroyed by freezing or by the highest natural temperatures that occur in this climate. During the summer months it will multiply in the soil, and in this way the poison of anthrax may be continued, in a contaminated soil, for a period of several years. When susceptible cattle graze in such a region, or drink the water that drains from soil contaminated in this manner, or inhale the dust arising from the dried vegetation from such a soil, the spores of anthrax that are thus carried into the body develop anthrax bacteria which produce this deadly disease. In some cases, the infection occurs through a wound in the skin. After the germs enter the body they multiply with great rapidity and frequently produce death within twenty-four hours, and sometimes in a shorter period. In other cases, the course of the disease may be prolonged to several days and, rarely, an animal may recover. In the very exceptional cases in which animals recover from

anthrax, it is found that thereafter they possess a marked degree of immunity from the disease and do not contract it as other cattle usually do when exposed.

The principal symptoms of anthrax are the high fever ranging from 104 degrees to 107 degrees F., red mucous membranes, rapid, bounding pulse; depression and prostration shown by loss of appetite, disinclination to move about with the herd and weakness that is indicated by an irregular gait and staggering. The faeces are sometimes coated with blood and sometimes there is a bloody discharge from the nostrils. When the infection takes place through the skin there is a local swelling at the point of inoculation. After death the carcass bloats quickly and if it is cut into it will be found that the blood is not firmly clotted, but is of a thick-fluid consistency and of an abnormally dark color. The internal organs are more or less engorged with this dark blood, the liver is friable, somewhat enlarged, and the spleen is usually greatly swollen and softened.

Whenever anthrax appears, it is important to so dispose of the carcasses of its victims that the soil may not become contaminated with its germs. This is best accomplished by burning the carcasses without opening them, because wherever a drop of blood falls the seeds of the disease may become established. If possible, the carcass should be burned on the spot where the animal dies. If this cannot be done on account of the surroundings the carcass should be loaded on to a stone boat and dragged to a suitable place, there thrown upon a loose pile of wood and cremated. If burning is not possible, the next best method of disposing of these carcasses is to bury them deeply away from water courses (where they would drain into a stream and might be washed out) and covered well with lime before the earth is thrown over them. Such graves should be so deep that there will be no danger of future accidental disinterment. If the animal dies in the stable the premises occupied by it should be cleaned in the most thorough manner and disinfected by a thorough washing and saturation with a solution of bichloride of mercury (corrosive sublimate) 1 part to 1,000 parts of water. As this solution is poisonous it must be used with care.

The germs of anthrax prefer low moist soils and remain alive longest in such places. The infection of the soil of a given region with the germs of anthrax is a serious matter and endangers the live stock for a considerable period thereafter.

During the past year, the outbreaks of anthrax that have been met with have occurred in Cumberland, Jefferson, Lancaster, Lycoming, Tioga and Warren counties. Most of these outbreaks evidently occurred from exposure on soils or in localities that had previously been infected and did not present points that render them unusual or exceptional in character. Two of the outbreaks, however, may be des-

ignated primary or original outbreaks and occurred in districts where there was no previous history of infection. In the cases of the first class, advice was given and measures were taken looking to the proper disposition of carcasses as recommended above. It has been recommended in several cases to drain and thoroughly lime fields that are known to be infected with the germs of anthrax. If such soils can be allowed to lie fallow for a year or two or can be planted in timber it is best to do so, for it is not strictly safe to use them for the growing of any food or fodder crop. If, however, they are used for the growing of grain it is probable that corn constitutes the safest crop, but in harvesting the corn it should be cut high, not less than two feet from the ground.

Animals can be reared in permanently infected districts and on permanently infected farms and fields if they are protected by vaccination. This protection is conferred by putting the animal through a mild course of the disease. The vaccines used for this purpose are attenuated cultures of the germs of anthrax that have been weakened and reduced, by laboratory methods, to such an extent that they cannot kill an animal or even cause disease in a dangerous form. Two vaccines are used: The first is quite weak and after the animal is thoroughly recovered from its effects it is vaccinated again with the strônger one. The first vaccine protects the animal to such an extent that the second is borne without difficulty. If the second, or stronger, vaccine were used first its effect would be so violent that the animal would be injured and possibly killed. In using anthrax vaccine it is necessary first of all to know that they have been carefully and accurately prepared and that they are in good condition at the time of use. It is also necessary to administer them with great caution and accuracy. Even when every precaution is observed there is a small element of risk that cannot be avoided, hence vaccination against anthrax is not used excepting when the conditions that give rise to the disease cannot be removed. It is very much better to prevent the infection of the soil and thus avoid the necessity for using the protective inoculations.

The two outbreaks of the second class, that have been referred to as primary or original outbreaks, occurred in Jefferson and Lycoming counties. In July, a letter was received from Falls Creek in which it was reported that eleven head of cattle had died during ten days, and that it was supposed that they had been killed by poison in the water that they drank. Part of this water came from a tannery that was at the time working on hides that were said to be heavily impregnated with arsenic and arsenical poisoning was suspected. The matter was at once investigated and it was found that the cattle had died as reported, but the report was so late that before any material

could be obtained for examination it was in an advanced state of decomposition and this made it impossible to obtain satisfactory results. But no traces of arsenic were found. In August, Dr. F. A. Hamilton, veterinarian, of Dubois, Pa., was asked to act as agent for the State Live Stock Sanitary Board and gather all possible information in reference to the diseased cattle. No more animals died from which fresh material for examination could be obtained until September 16, when a cow died at Reynoldsville eight miles below Falls Creek. This animal was examined post mortem by Dr. F. F. Hoffman of Brookville, September 18. He found the carcass puffy and putrid, the blood fluid and very dark, the lungs mottled and congested, the spleen 26 inches long, from 7 to 9 inches wide, 3 inches thick and quite friable. The liver was congested, enlarged and friable and the intestines were thickened, dark and soft. The carcass was burned. Some specimens from this animal were forwarded to the laboratory of the State Live Stock Sanitary Board and the germs of anthrax were isolated from them. Upon the receipt of this report, which was on the 19th of September, I at once visited Reynoldsville, Falls Creek and vicinity.

All of the sudden deaths among cattle occurred in animals pasturing along the course of the Falls Creek and Red Bank Creek within eight miles of the Falls Creek tannery. The drainage of this tannery is discharged into Falls Creek and at the time of the original fatalities among cattle and for some weeks thereafter the tannery was working on hides from China, which were imported through New York. It was claimed that these hides were strongly impregnated with arsenic and that for a time from one to two-hundred pounds of arsenic were discharged into the creek each day. It was not possible to ascertain, however, that this statement was true. During July and August, four workmen in the tannery at Falls Creek died of a rapidly fatal disease that was diagnosed by Dr. J. C. Booher an anthrax and two other men suffered with local infectious diagnosed as local anthrax or malignant carbuncles. After these cases developed the tannery was cleaned up and disinfected as thoroughly as possible and work on the Asiatic hides had ceased at the time of my visit.

So far as I know, the only bacteriological diagnosis that was made during this outbreak, in which the germ was carried through the necessary culture and inoculation tests, were made under the auspices of this Board, but Dr. Hoffman saw long rod shaped bacilli in the tissues examined. In the light of this work, and the diagnosis of Dr. Booher and the symptoms described by those who saw the diseased cattle it would appear that there is but little doubt that most of the animals that died suddenly in that vicinity during the summer of diseases that were looked upon as mysterious were really victims of anthrax. The losses of cattle amounted to from twenty-five to thirty head. Many

of these animals were ranging in the woods and the exact time of death was not known. In fact, it was not known that some of them were dead until their putrefying remains were discovered in the underbrush. At the time of my visit arrangements were made for a thorough search for carcasses through the pasture of that region, and provision was made for the destruction of such carcasses and remains of carcasses in a very thorough manner. In each case a fire was built over and around the dead body, thus thoroughly heating and sterilizing it. Afterwards the spot was well covered with lime, and stones or stumps were piled over it in such a way that no large animals could gain access to it. This work was efficiently performed for the State Live Stock Sanitary Board under the direction of Dr. Hamilton. The results of this work will not be apparent until next summer.

I also arranged for the prompt cremation of the carcass of every animal that should die of anthrax in the future. It is to be hoped that this thorough treatment of the carcasses has prevented a widespread infection of the soil, but the danger of continued infection resulting from the deposition of anthrax spores from the tannery along the banks of the stream below it must be considered and it is possible that future losses may result from this source. With a view of preventing, also, the further distribution of the germs of anthrax by animals it is proposed, during the coming spring, to vaccinate and protect the cattle kept on the low ground along this water course in the possibly infected area.

The other case of a similar character occurred in Lycoming county and is reported upon as follows by Dr. M. P. Ravenel, bacteriologist:

PHILADELPHIA, PA., December 14, 1897.

DR. LEONARD PEARSON, State Veterinarian:

Dear Sir: In accordance with your instructions to investigate the outbreak of anthrax at the Proctor tannery, for the purpose of ascertaining whether the cattle of that vicinity were endangered, I left Philadelphia on the evening of December 9th and reached Proctor at about noon on December 10th. Every facility was afforded me by the superintendent of the tannery, who gave me all the information in his power. In my examination of the premises I was accompanied and assisted by Dr. Gamble, one of the physicians in attendance on the case of anthrax now at Proctor. The tannery has been in operation for a number of years, and is now under the control of the Elk Tanning Company, which latter is under control of the United States Leather Company. The tannery is quite a large one, employing from sixty to seventy men. It is situated on Plunkett's creek, which empties into Loyal Lock, which in turn empties into the Susquehanna river at Montoursville. The refuse from the tannery is carried into Plunkett's creek.

I found the operatives were considerably excited over the cases of anthrax which have occurred lately, three in number, two of which have resulted fatally, while the third gave indications of the same termination. The origin of these cases is attributed by every one to the working up of hides imported from China, and the evidence that such was the case seemed to me conclusive. I was not able to get one of these hides in the raw state for bacteriological examination, as the last of them had been put into the bark solution, which seems to end the danger of the infection. I was told that all cases had occurred in men who handled them previous to this operation, and such would seem to be the case.

Among the operatives, these hides from China are generally considered to be animals dying of disease, and are known technically as "murrain" hides. They claim to be able to tell a murrain hide without fail, both by the appearance of it, and by its refusing to "plump up" during the working up of it. The superintendent did not share this opinion, but believed that a certain proportion of the hides was from slaughtered animals while others were from those dying from disease. All were bundled together without distinction, for shipment. He doubted also whether it was possible to tell certainly which was which, though he did not deny that it could be done. About June a year ago some ten head of cattle died about the tannery, the result, it is claimed, of drinking water containing refuse from the beam-room. No veterinarian examined them and no positive diagnosis can be given though it is believed by many that the cause of death was anthrax. This happened just after the opening up of the tannery on these hides from China. The deaths ceased on the fencing off of the water. I could not hear of any deaths down the stream among cattle. At any rate, the danger is now over, as the lot of hides is now exhausted. These hides are said to be a part of the same cargo which caused the death of four men and a number of cattle at and about Falls Creek in July and August last. This seems to be well authenticated, and is admitted, I was told, by the company operating the tannery.

No bacteriological examination was made in either of the two fatal cases of anthrax occurring at Proctor, the diagnosis resting solely on the symptoms. I made cultures from several points on the arm of the case under treatment then at Proctor, including the tissues about the site of the original pustule. From these I have obtained cultures of the anthrax bacillus, which proved fatal to guinea pigs on the third day, the organism being recovered from the blood and organs of the animal.

There is another tannery operated by the Elk Tanning Company situated at Ralston, some sixteen miles from Proctor. This plant is larger than the one at Proctor, and its refuse is poured into Lycoming

creek. The tannery is working hides said to be of the same cargo as those at Proctor. The superintendent, Mr. Woodworth, told me tha some twenty-four cases of anthrax had developed among the operatives, the diagnosis being based entirely on the symptoms, no bacteriological examinations having been made. I learn from others that three fatal cases had occurred, but this I was not able to confirm. It is certain that at least one fatal case occurred there. There had been five cases recently, all of which ended in recovery. About one year ago all the fish down the stream for some distance died, and could be picked up on the banks or in the small springs along the shore, where they seemed to go in search of pure water. The death of the fish is attributed to refuse of the tannery at Ralston. During the past summer ten or twelve head of cattle have died along the stream. Six died at Bodine, four miles below the tannery, within one month's time. They were supposed at the time to be poisoned. Only one was examined by a veterinarian, so far as I could learn. Death in the cattle took place as far down the stream as Trout Run, ten miles below the tannery. Specimens from one of these cattle were examined on September 8th, but I failed to find the anthrax bacillus. The symptoms of many of the cattle, as described to me, resembled anthrax very closely.

In the time at my disposal, I was not able to verify all the statements made to me by different parties, but I have endeavored to give what appeared to me to be well substantiated facts.

Bacteriological examination of the case at Proctor at the time of my visit leaves no doubt as to the nature of the disease. Bacteriological examination of the tissues of one of the cows which died at Falls Creek in September last also proved the disease to have been anthrax beyond question.

All of which is respectfully submitted,

MAYZCK P. RAVENEL, M. D.,
Bacteriologist of the State Live Stock Sanitary Board.

These two outbreaks illustrate one of the important ways in which anthrax is carried long distances. Unfortunately, there appears to be no simple way by which we can protect ourselves from the danger resulting from the use of such infected hides. No method has yet been discovered for the safe, efficient and economical disinfection of hides, and although attempts have been made upon the part of the Federal Government to plan and enforce such disinfections in the case of hides from suspected sources, they appear to have been evaded in a few cases. It seems that in some partly civilized countries the hides are removed from animals that die of anthrax and are exported. There is a provision against the importation of hides from districts

where anthrax is known to exist, but as the hides do not always come directly from such districts the regulation does not fully prevent their importation. It has been shown by Griglio, an Italian investigator, that the spores of the anthrax baccillus are even more resistent than is usually supposed and that the usual, so-called, disinfection to which wool and hair and hides are sometimes submitted is futile. He has found that the salting of hides and steeping of the skins in brine does not destroy the spore, nor does soaking of the dried hides in milk of lime, nor prolonged drying, and other observers have noticed that treatment even with arsenic does not disinfect the skins. One reason for this may lie in the fact that spores exist not only on the surface of the skin, but in the deeper parts, whither they are carried in the circulation.

It is to be hoped that in the future reports of outbreaks of anthrax, or of any rapidly fatal and suspicious disease among cattle, will be reported promptly to the State Live Stock Sanitary Board so that in case it should be found that this disease exists the proper measures can be taken at once and the permanent infection of new localities can thus be prevented.

The demand for anthrax vaccine seems to be increasing, but provision has been made for producing a sufficient supply in the laboratory to meet all probable needs.

With continued careful oversight of the localities in which anthrax has developed, the proper disposition of all suspected carcasses and a judicious use of vaccine, there is every reason to believe that the disease can not only be kept within present bounds, but that it will, in time, be suppressed.

Respectfully submitted,

LEONARD PEARSON,

State Veterinarian.

MISCELLANEOUS PAPERS.

BY THE SECRETARY.

NOTES ON FOOD ADULTERATION AND FOOD LAWS.

ANTIQUITY OF LAWS RELATING TO BREAD AND MEAL.

The attempt the regulate the quality of food products by law appears to have originated during the reign of King John, in the year 1286, when what was known as the "Assize of Bread" was instituted; this appears to have remained almost intact until the year 1582, when it was modified, enlarged and other articles added. In 1582 there was placed on the statute books of England an act, entitled as follows:

"Here beginneth the boke named the assyse of bread, what it ought to weye, after the pryce of a quarter of wheat; also the assyze of ale, with all manner of wood, cole, lath, bolside and tymber, and the weight of butter and cheese."

One of the provisions of this act was as follows:

"If there be any that by false meanes useth to sell meale; for the first time he shall be grievously punished, the second tyme he shall lose his meale; the III tyme he shall foreswere the towne, and so likewise the bakers that offende. Also bouchers that sell mesell porke or mozen flesche; for the first time they shall be grievously amerced, for the secon tyme so offendinge they shall have the judgement of the pillory, for the third tyme they shall be comytted to pryson until ransomed, and for the fourth tyme he shall foreswere the towne, and thus ought other transgressors to be punished, as cooks, forestallers, regators of the markets when the cookes serve, roste, bake or any otherwise dresse fysche or flesche unwholesome for mans body."

In 1634 the laws regulating bread were again changed as is shown by the following from a law of that year:

"If there be any manner of person or persons, which shall, by any false ways or means, sell any meale unto the kinge's subjects, either by mixing it deceitfully, or sell any musty or corrupted meal, which may be to the hurte or infection of any mans body, or use any false weight, or any deceitful wayes or meanes, and shall so deceive the subject, for the first offence he shall be grievously punished; the second he shall lose his meale; for the third offence he shall suffer the judgement of the pillory and the fourth time he shall foreswere the town wherein he dwelleth."

In 1382, under date of October 11th, the Provost of Paris, published a decree relating to the adulteration of bread and flour and the use of false weights in the manufacture or sale of bread, and in 1526 according to Blyth, an offending French baker was "condemned by the court to be taken from the Chatelet prison to the cross before the Eglise des Carmes and thence to the gate of the Notre Dame and to other public places in Paris in his shirt, having the head and feet bare, with small loaves of bread hung from his neck, and holding a large wax candle lighted, and in each of the places enumerated he was to make 'amende honorable' and ask mercy and pardon of God, the king and of justice for his fault."

Blyth also states that in 1699 a French baker was convicted of having mixed good and bad flour together and of having the two kinds of flour in his shop with the intention of mixing them; he was fined 500 livres, his oven destroyed and his shop closed for six months, with a placard upon it stating the crime and punishment.

In 1272 local enactments were in vogue in Germany, but there does not appear to have been any national or general law relating to either bread or meal. In the year named, two bakers were appointed by the proper authorities of the town of Berlin, and they were held personally responsible for the quality of bread offered for sale, and had power to punish offenders and (apparently) also to regulate by rule the classes of offense which might be committed. In some places convicted bakers were placed in baskets and dipped, at the end of a long pole, in the nearest muddy pool or duck pond.

In England one "Alan de Lyndseye (probably a Frenchman) was sentenced to the pillory because he had been convicted of baking 'pain demayn' that was found to be bad dough within and good dough without, and because of such falsity redounds much to the deception of the people who buy such bread."

In 1592 there was issued in England a small work, entitled "A Quip to an Upstart Courtier," which shows, at least to a certain extent, the condition of the baker's trade at that time. It contains the following scathing charges against dishonest bakers:

"And for you goodman baker, you that love to be seen in the open market-place upon the pillory, the world cries out on your wiliness; you crave but one deere yeare to make your daughter a gentlewoman.

You buy your corne at the best hand, and yet will not be content to make your bread weight by many ounces. You put in yeaste and salt to make it heavie, and yet your police cannot make it. The poore crie out, the rich find fault, and the lord maior and the sheriffs, like honorable and worshipful maiestrates, every daie walk abroad and weigh your bread, and yet all will not serve to make you honest men. But were extremeities used and the statutes put in the highest degree in practice you would have few eares on your heade as the collyer."

ANTIQUITY OF LAWS RELATING TO DRINKS.

To the citizen of the present day it will appear strange that our English ancestors found it necessary to protect their drinks against fraud before it was thought to be necessary to protect articles of food, and yet such appears to be the case, for in 1529, the office of "Ale-taster" was created; these officers were required to take the following oath: "You are chosen ale-tasters of this town. You shall well and truly serve his Majesty and this town in the same office. You shall at all time try, taste and assize the beer and ale put on sale in this liberty, whether the same be wholesome for a man's body and present those that offend or refuse to suffer you to assay it; you shall give your attendance at all courts and present from time to time the offenders and all things else belonging to your office you shall do and execute. So help you God."

It would appear from the manner in which some of these tests were made that the addition of sugar to ale was considered a disadvantage and an offense, but the mode of deciding the presence, in improper amounts of this adulterant would hardly stand the tests of the courts of the present day. The "ale-tasters" wore leather breeches; a portion of the suspected ale was poured out upon a wooden bench; the "taster" sat down in the wetted place and if, after the ale had partially dried out, his breeches stuck to the bench the ale was adjudged illegal and the manufacturer and seller punished.

In 1592, in a work called "A Quip to an Upstart Courtier," the following is given in relation to the then very important class of men known as brewers:

"And you maister brewer, that growe to be worth forty thousand pounds by selling soden water, what subtilty have you in making your beere to soare malt, and out in more of the hoppe, to make your drinke, be barley never so cheap, not a whit stronger, and yet never sell a whit the more measure for money. You can when you have

taken all the harte of the malt away, then clap on store of water, it is cheap enough. And mash out a turning of small bere, like Rennish wine; in your conscience how many barrels drwo you out of a quarter of malt? Fie, Fie, I conceal your falsehood least I should be too broad in setting down your faults."

The same writer paid his attentions to the "tapsters" in the following manner:

"Last to you, Tom Tapster,-that take your small cannes of beere, if you see your guestst begin to be drunke, halfe small and halfe strong; you cannot be content to pinch with your small pottes and your ostrie faggots, but you have your drugges and draw men on to villany and to bring customers to your house, where you sell a joint of meat for XII pence that cost you six, and if any chance to gomon the skore you skore him when he is asleep and set a pot a day more than he hath, to find you drinking pots with your companions. To be short, thou art a knave."

In 1553, one Paul Barnardo appears to have brought a large lot of wine into London. According to custom the mayor appointed six vintners to examine the wine and report whether it was pure and fit to be admitted into the city. In their "analyses" they report that they found bundles of weeds in eight of the pipes; sulphur in four of the others; a piece of match in one, and "a kind of gravel mixture sticking to all of the casks which they conceived to be unwholesome." The whole lot of wine was condemned and the importer sent out of the country.

In 1697 a poem, entitled "A search after claret," was published in London, on one leaf of which was the following advertisement:

"If any vintner, wine-cooper, &c., between Whitechapel and Westminster Abbey have tuns or hogsheads of old, rich, unadulterated claret and will sell it as the law directs for six pence per quart, this is to give notice that he shall have more customers than half his profession, and his house be as full from morning to night as a conventicle or Westminster Hall the first day of the term."

In his Tattler (1710), Addison thus pays his respects to those who manipulated and adulterated the wines of his day:

"These subtle philosophers are daily employed in the transmutation of liquors, and by the power of medical drugs and incantations raise under the streets of London the choicest products of the hills and valleys of France; they squeeze Bordeaux out of the sloe, and draw Champagne from an apple."

In Germany, where all laws are usually severe, those relating to adulterations of drinks appear to have carried rather severe penalties with them; thus, in 1842, a man who had been detected in adulterating his wine, was sentenced to drink six quarts of it and finally died from the effects. In 1435, the records state that "The taverner Christian Corper were put upon a cask in which they had sold false wine and

then exposed to the pillory. The punishment was adjudged because they had roasted pears and put them into new sour wine in order to sweeten the wine. Some pears were hung around their necks like unto a Paternoster."

In 1400, for sulphuring wine and adding sugar, honey and other sweet material to it, two vintners were publicly branded and severely punished.

GENERAL ADULTERATION.

One of the best authorities upon adulteration of food in England, has the following in relation to the general question:

"Adulteration is now a fine art; it will soon be an exact science. Its professors enter upon their work with a precise knowledge of the end they have in view, and with all that science and skill can do to help them in reaching it.

Its aim is by no means solely to defraud—indeed, in some cases fraud is not even contemplated, so that to deal adequately with it by means of legislation, a variety of other considerations must be entered into, although beyond those connected with its criminal aspect.

Many of the commoner modes of adulteration are plainly swindling, and nothing whatever can be said in their favor; adding water to milk, starch or sand to pepper, selling margarine instead of butter, or exhausted leaves instead of sound tea.

In other cases where fraud is equally obvious, it is pleaded, sometimes rightly, sometimes wrongly, that certain things must be added to or abstracted from the natural article in order to render it palatable or disgestible. The public, it is sometimes said, prefer chicory in the coffee, and flour in their mustard. Pure cocoa, it is averred, is indigestible and, therefore, it is mixed with large proportions of starch and sugar.

In other instances again, an adulterant is added in very small and almost inappreciable amount (so that no fraudulent increase in bulk is brought about), with the object of delaying or preventing decomposition—as when boracic acid is added to milk or butter, or salicylic acid to wines and jams.

Formerly the exigencies of fashion or fancy requiring that preserved peas and other vegetables should possess the green color of the fresh article, it was the custom amongst manufacturers of the highest repute to boil them in copper vessels until the proper shade was obtained. Similar, but less objectionable processes, are doubtless em-

ployed at the present time, and in places where the adulteration acts are not carried out, the barbarous practices of the past are probably still in full swing.

New modes of adulteration arise as old ones die out, and because of the greater attention and knowledge brought to bear on all sanitary matters, some customs which formerly passed unheeded are now vigorously condemned. But science and sophistication progress together and the old-fashioned crude and clumsy frauds, and equally crude methods of detecting them, are rapidly disappearing, to be replaced by refined and more delicate scientific processes. Science is by no means all on the side of honesty, and while its records are open to the adulterator, his movements are involved in darkness, only to be penetrated by fresh efforts from the other side, and thus to a certain extent the adulterator is always one step ahead.

Perhaps the most striking features of the latter-day sophisticator of food is his knowledge of the law and his skill in evading it. If a legal limit of strength or quality be fixed for and substance (as in the case of spirits), he carefully brings his goods right down to it, and, perhaps, just so little below that no magistrate would convict him. Where substances naturally vary in their composition within a wide range—as, for instance, milk and butter—he carefully arranges that what he sells just manages to escape condemnation, because there is about one chance in ten thousand that it may be genuine. He is well aware that nature and commerce are ransacked for new products suitable for the adulterators' use, and old ones are refined and purified so as no longer to answer to the chemist's call."

LIMITATION OF ANALYSES.

It is impossible for any provisions of law to cover all cases of adulteration which may come up under pure food acts and, hence, in England, the Society of Public Analysts have, by mutual agreement, established certain limits within which food shall be deemed not to be adulterated and, by converse reasoning, certain limits within which it shall be considered to be adulterated; these limits are, substantially as follows:

Foods or drink are deemed to be "adulterated"

1. If it contains any ingredient which may render such article injurious to the health of the consumer.

2. If it contains any substance that sensibly increases its weight, bulk or strength, or gives a fictitious value, unless the amount of such

substance present be due to circumstances necessarily appertaining to its collection of manufacture, or be necessary for its preservation, or unless the presence thereof be acknowledged at the time of sale.

3. If any important constituent has been wholly or in part abstracted or omitted, unless acknowledgment of such abstraction or omission be made at the time of sale.

4. If it be in imitation of, or be sold under the name of another article.

In the case of drugs they shall be deemed "adulterated" if

1. When retailed for medical purposes under a name recognized in the British Pharmacopoeia, it be not equal in strength and purity to the standard laid down in that work.

2. If, when sold under a name not recognized in the British Pharmacopoeia, it differs materially from the standard laid down in approved works on materia medica, or professed standards under which it is sold.

The same authority has laid down the following "limits" for the articles referred to:

Milk.—Shall contain not less than 9 per cent. by weight of milk solids not fat, and not less than 2.5 per cent. of butter fat.

Skim Milk.—Shall contain not less than 9 per cent., by weight, of milk solids not fat.

Butter.—Shall contain not less than 80 per cent. of butter fat.

Tea.—Shall not contain more than 8 per cent. of mineral matter, calculated on the tea drier at 100 C, of which at least 3 per cent. shall be soluble in water, and the tea as sold shall yield at least 30 per cent. of extract.

Cocoa.—Shall contain at least 20 per cent. of cocoa fat.

Vinegar.—Shall contain not less than 3 per cent. of acetic acid.

BUTTER.

In the present condition of the trade and with the present range of prices there are but few articles used in butter which can properly be styled adulterants. The most common are water and casein. The former usually is present in undue amounts through carelessness in its manufacture, and the latter from the same cause; but there are cases within the experience of the Department in which both have been present in undue amounts by design and with the express intent to defraud the purchaser.

In the case of casein, preparations have been added which have the power to coagulate the casein or cheesy matter of the milk and cause it to be incorporated within the fat of the butter; by the addition of coloring matter this fraud is somewhat difficult to detect except by a somewhat careful analyses. A mixture of sulphate of soda and pepsin has been used and a number of patented preparations have, from time to time, been exposed by the officers of the Department.

One of our best English authorities gives the following as the limitations of the component parts of butter:

Water, ...	8 to 14 per cent.
Fat, ...	80 to 88 per cent.
Curd (casein), ...	0.5 to 3 per cent.
Salt, ...	0.5 to 5 per cent.

One of the chemists of the Department reports having found as high as 45 per cent. of water in one sample of butter, and an English authority gives 50 per cent. as the maximum known amount which has been incorporated with the other ingredients. English law fixes 14 per cent. a maximum, but seldom convicts on less than 20 per cent. Dr. Bell states that "a greater amount of water than 12 per cent. is unnecessary so far as attaining a good appearance is concerned, and anything over 16 per cent. is injurious to the keeping qualities of the butter."

In recent years there have been but few attempts made to increase the profit of butter making, but by the abstraction of the butter fat and the addition of foreign fats, such as cotton seed oil, oleomargarine or other low grade and cheap fatty materials. This is partially due to the low price of butter, and partially to the active attention of the special agents of the Department, some of whom, by simple test, the materials for which they carry with them, are able to detect adulterations of this character with sufficient exactness to permit them to judge as to the necessity of sending the sample to the chemist.

In our own State at least two attempts to adulterate butter with foreign material have been detected. In southeastern Pennsylvania an article known as "cream ripener" was for a short time used; this was proven to be a mixture of some substance with cotton seed oil, and the main gain to the butter maker was through the fat added in the form of the cotton seed oil.

In other cases pepsin was added to other matter to give the article bulk, and added to the cream in certain proportions; the effect was to coagulate or thicken a portion of the casein of the milk and by mechanically mixing it with the butter fat, materially increase the weight of the resultant compound, but this plan, unless greatly improved, can not be adopted by manufacturers of first class butter, for its use is always revealed in the material produced, it losing more or less of the character of first-class butter.

In England much more attention is paid to the presence of an undue proportion of water in butter. Blyth, in alluding to the percentage of water, draws the following conclusions:

"There is no standard followed or fixed with regard to the percentage of water. In those cases in which the fat is below 80 per cent., the deficiency in fat is usually from excess of water; and seeing the variable quantity of water found in butter, it is wisest not to certify on the ground of water alone, unless there is sufficient to lower the percentage of fat below 80."

In Manchester (England) in the cases of Rook vs. McComas and Rook vs. Madders, a large amount of evidence bearing upon the amount of water found in butter was produced; in the first case 21½ per cent. was proven to have been present, and in the second 22½. In his charge the judge (Headlam) used the following language:

"It seems to me a question which can only be properly determined by the legislature, after proper inquiry from both sides. The Irish butter trade is a large and important one, especially in this district, and there is some danger, if too high a standard is adopted, that the trade may be driven out of the market; and, on the other hand, if the standard is too low, it would produce carelessness and fraud on the part of the manufacturer in leaving water which could have been pressed out. If water is kept in, it seems to me absurd to say that butter is not sold to the predjudice of the purchaser."

From a large number of analyses made by English chemists, we find the average of the water to have been 12.60 per cent., the minimum being 10.72, and the maximum 14.00.

DECISIONS UNDER ENGLISH FOOD LAWS.

The food laws of England having been in force much longer than those of any of our states, it is reasonable to suppose that those who sell articles coming under the provisions of such laws are much better posted than is the corresponding dealer in the United States. It is also but reasonable to suppose that English courts are furnishing decisions which are being accepted as a guide by our own courts, and it is equally reasonable to suppose that finer questions are raised, that attorneys are better posted, and that jurors are better acquainted with the provisions of the law in England than in this country. Hence, we find that some of the decisions of English courts cover fine points not yet raised in any court in the United States, but which are being rapidly imitated by the courts of our own country.

In England it is evident that the pure food inspectors find the same difficulty with misleading labels as do our officers, and that the words "substitute," "mixture" or "compound" are there, as here, placed on the packages in extremely small type and often in positions in which they are defaced or obscured after the package has been handled a few times.

In the case of Liddiard vs. Reece, Blyth reports the following as practically the decision: A grocer sold a half pound of a mixture of coffee and chicory to an inspector. The mixture was contained in a canister and was duly weighed, and the full price of coffee paid. After the sale had been completed the purchaser informed the appellant that he intended to have the article analyzed. Thereupon, while the packet was still on the counter, the appellant called the attention of the purchaser to the label, on which the purchaser for the first time noticed the words "this is sold as a mixture of chicory and coffee," printed in distinct, legible characters. The label was affixed in a conspicuous position on the outside of the packet. The purchaser then said that he had asked for "coffee," and not "chicory and coffee." The mixture was found by the analyst to consist of 60 parts of coffee and 40 parts of chicory. On the hearing of the case before the magistrate, they convicted the vendor on the following grounds: "The fact that the purchaser asked for coffee and was supplied with an article consisting of only 60 per cent. coffee and 40 per cent. chicory, without having his attention called to the label, and without, in fact, seeing it until the purchase was completed, and also the fact that the price he paid for the said article was a usual and fair price for pure coffee and much more than would have been given for coffee mixed with chicory to the above extent, therefore, the appellant was not protected by the said eighth section."

In a somewhat similar case in which, however, the article sold contained material injurious to health, the ruling was in effect that "it is no defence under this section that the article was sold with a label to show it was a mixture, as the provisions as to labels in section eight do not extend to mixtures injurious to health; it is not necessary for the purchaser to be prejudiced as it is under section six, so that notice to him of the mixture given orally or by placard in the shop would appear to be no defence under this section."

Blyth gives the following relating to the relation between the wholesale dealer under English law:

"It is not sufficient for a tradesman to be honest to escape legal penalties for adulteration; he must see that the wholesale dealer from whom he purchases is honest also.

"The first precaution to be taken is to obtain a written guarantee from the wholesale dealer that the article is of the same description as that under which it is proposed to be sold to retail purchasers. A mere invoice describing the article as pure is not enough. Thus, an

invoice describing milk as 'new and pure milk' is of no use, but the words 'warranted new and pure milk' would be sufficient protection against a prosecution under the sale of food and drugs act.

"In the case of a running contract where milk, for instance, is to be supplied for six months by daily deliveries, it is not sufficient for the contractor to warrant the milk pure, but there must be an invoice or label delivered with each particular parcel so describing it as to bring it under the contract and to show it is a delivery under it. Thus, where a running contract warranted the quality of the milk as the best milk, and a label was affixed to each churn (can) delivered, describing it as genuine new milk with all the cream on, it was held that the label and contract together formed a good warranty of the specific article delivered."

In the case of Payne vs. Hack, it was held that if the vendor demands evidence of the authority of the person professing to be a public officer, and if the latter has no badge or other mark to denote his authority, and is unknown to the vendor, the officer is bound to produce the authority under which he acts. The production of his appointment or a certificate from the clerk of the local authority is sufficient.

If however, the inspector is in uniform, or has other marks showing him to be a public officer, the vendor must be deemed to know that he is acting in such capacity, as his uniform is prima facie evidence of the fact. If the vendor makes no inquiry of the purchaser as to what authority he acts under, he will also be taken to know that he was a public officer.

Blyth states that "in the case of a grocer who sold adulterated coffee, the vendor had received the money, and had laid the packet and also the change on the counter, but on hearing the errand of the purchaser, he laid his hand on the change and the packet, declaring the sale was not complete, as he had not given the change and also that he did not sell the goods as not adulterated. But the magistrate very properly held that the defense was not admissible."

In another case mentioned by a standard legal authority, it is stated that "a seller of milk had a van (wagon) on which the notice was placed 'country skimmed milk, sold as adulterated milk.' The man, with his can, went on foot from door to door, the van being in the road. It is evident that, in such a case, very few of the customers could have seen the label. An inspector who bought a sample of the milk did not see it and the magistrate convicted the defendant."

Robinson & Cribb rule that "a master is expressly liable under this section for ordering or permitting a servant to mix injurious ingredients with food, and where a servant gains nothing by adulterating an article and the master reaps the profit, a strong presumption is raised that the master permitted the act of his servant. The master is responsible for the act of his servant in selling an article under this section unless he can prove ignorance under section five, or that he

could not by reasonable diligence have obtained the knowledge. If, however, he has neglected to exercise a reasonable supervision over his servants, this would no doubt constitute want of reasonable diligence."

In the case of Warnock vs. Johnson, a farmer had been convicted by the officer of selling butter-milk containing 30 per cent. of water. It was proved that the addition of some water was necessary, the quantity depending upon the temperature. The analyst put it at 20 per cent., while trade witnesses proved it varied from 25 to 50 per cent. The High Court of Justiciary of Scotland held the case came under the exemption clause of the section, as the water was not proven to have been added with intent to cheat the public or to prejudice the purchaser. Lord Young said: "I am disposed to agree that the statute does not apply to a greater or less quantity of extraneous matter being used in the manufacture of the article; the skill in manufacture consists in determining the quantity of ingredients to be used in the operation."

BUTTER-FAT IN CHEESE.

It has been claimed that, even under as nearly as possible the same circumstances and surroundings, the cheese manufactured by the same factory during different days would vary somewhat. Ten samples of cheese made upon ten consecutive days, at the factory of Hon. J. B. Phelps, of Conneautville, Crawford county, Pa., were taken carefully by sections, and sent to the chemist of the Department without instructions. So far as possible, the feed of the cows, the mode of manufacture, and all surroundings were identically the same. The results as returned by Prof. Aschman, including dates, were as follows:

Date.	Butter Fat.
July 21,	41.77
July 22,	42.26
July 23,	42.67
July 24,	39.89
July 25,	41.77
July 26,	40.38
July 27,	43.31
July 28,	42.35
July 29,	39.79
July 30,	42.27

It is a well-known fact that with precisely the same milk, the cheese may, and usually will, vary slightly; during some days the milk will "work up" better than others. Too great pressure at the commencement may force some of the butter fat out with the first running of whey, and other causes, some of which are not within the control of the manufacturer, will also cause more or less variation.

It was stated that samples taken from different portions of the same cheese would show variations in the amount of butter fat of sufficient importance to convict honest manufacturers and dealers; to test the validity of the point, a sample plug was taken entirely through a large Ohio full cream cheese and, excluding the rind on both sides, the plug was divided into five equal sized samples, which were lettered or marked A, B, C, D and E. The results of the test made by Prof. Aschman were as follows:

A,	35.29
B,	34.16
C,	34.66
D,	34.74
E,	35.23

An analyses of the whole piece, after careful mixing, was 34.72 of butter fat.

In another test, samples, eight in number, were taken from different parts of a 40-pound full cream cheese and lettered A, B, C, D, E, F, G, and H. The results of their analyses were as follows:

A,	33.61
B,	32.96
C,	32.65
D,	33.17
E,	32.75
F,	32.63
G,	32.63
H,	32.62

The rind which, in all cases was discarded in selecting the trial samples, gave 40.34 of butter fat.

A large plug taken clear across a large full cream cheese and divided in the cross section into four samples, the rind being discarded, gave the following results. Samples A and C were nearest the centre and B and D nearest the rind or outside:

A,	35.53
B,	34.92
C,	34.66
D.	35.51

In another series of analyses by Prof. Cochran, the results were as follows:

A,	32.60
B,	33.75
C,	33.37
D,	32.25

The statement was made by dealers that the standard for a full cream cheese was, by provisions of the act, fixed so high (32 per cent. of butter fat) that it was out of the question to reach it. Profs. Aschman, Frear and Cochran were each directed to obtain 100 samples of cheese in their respective localities and carefully test them; their reports demonstrated, what was in reality known before, that the State standard of 32 per cent. of butter fat was low and in favor of the cheese manufacturers.

Various questions relating more particularly to the interest of the factory owner in the manufacture of the product, which were not tested by the Department, were considered and the following conclusions by Dr. H. H. Dean, reached only after repeated experiments, were accepted as substantially correct for this State as well as Canada:

"1. Whole milk is not valuable for cheese making in proportion to its weight of volume, as 100 lbs. of 3 per cent. milk will make about 1½ lbs. less cheese than 100 lbs. of 4 per cent. milk.

"2. Whole milk does not produce cheese exactly in proportion to the butter fat contained in it, as 1 lb. of fat in milk testing an average of 3.23 per cent. produced 2.78 lbs. of cured cheese, while 1 lb. of fat in milk testing an average of 4.2 per cent. produced an average of 2.52 lbs. of cured cheese.

"3. The yield of cheese is fairly uniform in proportion to the fat and casein contained in the milk, when the latter is represented by adding 2 to the percentage of fat. This method gives results slightly lower than the actual yield of cheese, for milk testing under 3.25 per cent. of fat, and slightly above the actual yield for milks testing over this percentage of fat.

"4. Percentage of fat in the whey was greater from rich milk than from poor milk, but the loss of fat per 100 lbs. of cheese made did not differ materially until milk with over 4.50 per cent. of fat was used.

"5. The relation of the fat of the milk to the quality of the cheese produced is the most difficult point of all to settle, as there is so much difference of opinion as to what constitutes 'quality' in a cheese. It is difficult to get two judges to agree as to the number of points which cheese should be scored; and there does not seem to be a very definite relation between points scored and the market or money value. A cheese that would bring top price in one market might not do so in an-

other. At present there is not enough discrimination made in cheese sold on the markets. All our cheese made at the College were sold for the same price each month.

"6. The cheese made from poor milk had a tendency to become harsh in texture, which may be partially remedied by using less salt and leaving more moisture in the cheese. Rich milk has a tendency to produce cheese somewhat 'pasty' and 'slippery' in character, which may be partially remedied by the use of extra salt and by cooking one or two degrees higher than usual. The flavor, closeness, even color, and texture of a cheese are somewhat dependent upon the fat present in the milk and retained in the cheese, but with normal milk there are a number of factors equally important in the manufacture and sale of Cheddar cheese. Among these are, (1) what may be called good physical qualities in the milk, such as smell and taste; (2) skillful making; (3) differences in the tastes of judges and consumers.

"7. The percentage of fat in milk, plus 2, is a fair basis upon which to distribute the proceeds among patrons of cheese factories."

IGNORANCE OF ADULTERATIONS.

In a number of prosecutions brought by the Department for offering or selling adulterated goods, the dealers claimed exemption from punishment upon the plea that they were not aware of the adulteration. In such cases, where the evidence is such as to lead up to a belief that the plea is an honest one the Department uses the retailer as a witness against those from whom he purchased the adulterated goods, and releases him.

In England the construction of the law is such as will not release the retailer, and it is made his duty to know, by guarantee or other means, that the articles sold are as represented. This is usually done by a guarantee from the wholesale dealer, and the officers of the Department have in all cases advised this course to all retailers, and it has been very generally adopted. In many places associations of retailers have been formed, and the character of all goods purchased by members of the association closely scrutinized, in many cases to the extent of an analysis.

In referring to the effect of ignorance upon the part of the retailer, Robinson & Cribb write thus:

"In prosecutions under this section, it is no defence to prove ignorance of the seller as to the adulteration. This is an exception in the interests of the public health to the general maxim of law that

criminal responsibility does not attach to a man unless it can be shown that he did the act charged against him with a criminal intent, or 'actus non facit reum nisi mens sit rea.' If the general maxim had been applied to the sale of food acts they would practically have become a dead letter."

So strictly is this principle enforced under the English food acts that, in the case of Betts vs. Armistead, in which it was shown that the bread baked and sold by Armistead contained alum, he was convicted, although he showed conclusively that the alum was in the flour when he bought it and that he had no knowledge of its presence.

In the English case of Hotchin vs. Hindmarsh, the manager of a large dairy company sold adulterated milk to one of the government inspectors; the attorney for the manager made the claim that the company, and not the manager, should have been prosecuted. It was, however, ruled that the manager was the real seller and, therefore, liable to prosecution, Judge Coleridge ruling that "if the physical acts were done with requisite intent, the person who does the act must be treated as a principal, whether he be a servant acting for a master or not. He may come within section six whether he be principal or agent."

In the case of Fitzpatrick vs. Kelly, the Queen's Bench held that it was not at all necessary to prove that the seller had a knowledge of the adulteration of the butter sold; the fact that he sold it was all that need be proven.

The third and fourth sections of the English act of 1875 contain the words "to the knowledge of such person," but in section sixth no such words are used. In the case of Brown vs. Foot, Judge Wills ruled that the fact that this provision was left out showed conclusively that it was purposely omitted, and that it was not, therefore, necessary to prove a guilty knowledge or to quote the exact words, "those conditions are left out of this act of parliament and they must have been left out purposely; there can be no doubt of that."

In the case of Brown vs. Foot, it was shown that the servant watered the milk and sold it for "new milk" by outcry along the street; the employer proved that he required each man, when he went out from the dairy, to place a well-mixed sample of his milk on a particular shelf, and that these and other precautions were taken to prevent adulteration by servants. The servant, under oath, admitted that he had watered the milk, but it was not shown either that his master knew it or that the servant profited by the adulteration. In this case the proprietor of the dairy was convicted, Judge Hawkins ruling that "the master for all purposes must be deemed to be the seller of the milk; that is to say, it is impossible to say that he was not the seller of the milk. There is no doubt that civilly he would be the person alone who would be to blame, and the master would be responsible to the purchaser for any injury sustained by him. I think not merely

the servant who sells the milk is so, but the master himself is also responsible, and it cannot be said that he was not the seller of the milk. Cognizance of the fact that the milk was adulterated when sold may be a very material ingredient for the magistrate to take into consideration when he come to fix the penalty to be inflicted on the person who sells it, but it is not essential to the sufficiency of the proof which is to support the conviction."

In the case of Dyke vs. Gower, it was shown that the milk purchased by the prosecutor had 33 per cent. of its cream removed. It was shown that the milk had been sold, by measure, from a deep can, and that the milk had not been kept stirred up during the operation of peddling it along the street, the inference being that the first purchasers took with them a portion of the cream which naturally belonged to those who came later.

The Queen's Bench division held that allowing the milk to be sold amounted to "abstraction" within the meaning of the section under which the prosecution was brought, and ordered the conviction of the person selling the milk.

In the case of Morris vs. Corbett, it was shown that the servant of a dairyman, finding that his supply of milk was running short and that he would not have enough to supply all of his customers, bought two gallons and poured it into the can with the remainder of his master's milk. An inspector found the milk to have lost 20 per cent. of its cream, and although it was clearly shown that neither the dairyman nor his servant knew anything of the abstraction of the cream from the purchased milk, yet the former was convicted, but this ignorance was considered in inflicting the penalty.

In the case of Platt vs. Tyler, it was shown that the defendant was selling condensed milk with the following printed on the label: "Calf Brand—This tin contains skimmed milk with nothing added but the finest sugar. By the addition of a little water it may be used for almost every purpose for which ordinary skimmed milk is used." It was proven that 80 per cent. of the cream had been taken from the milk before it was condensed. The justice found as a fact that the inspector did not know that he was buying an article from which a portion of the cream had been taken, and, under the claim that the label was not sufficiently plain and distinctive, fined the defendant fifty dollars.

In the case of Kearsley vs. Tyler, it was shown that a servant had sold an inspector a pound of lard with a wrapper stating that it was "margarine," and although it was shown that there were two piles of wrappers, one marked "margarine" and the other "lard compound," and that the servant, by mistake, had used the wrong wrapper, yet the proprietor was convicted.

BAKING POWDER.

As there is no standard of strength for baking powders, it is difficult to secure conviction so long as the adulterating or value lessening material is of a harmless character. The most common addition is one or more of the various and cheaper forms of starch which add to the bulk, decrease the cost and enable the manufacturer to compete with a low-priced article.

It is claimed and admitted that a certain proportion of starch is necessary to prevent premature action upon the part of the two classes of ingredients of which the powder is composed, and if it were practicable, and the percentage absolutely necessary could be fixed, much of the present adulteration practiced in the manufacture of this article might be prevented.

Robinson & Cribb lay down the following rules for the composition of a baking powder:

"1. It should yield from 10 to 13 per cent. by weight of gas (carbonic acid) and on being moistened, that is, each ounce should give between 96 and 125 cubic inches, which should not be evolved too quickly.

"2. There should be no great excess either of the acid or the alkaline ingredient.

"3. The starch should form not less than 10 nor more than 20 per cent. of the mixture.

"4. The residue left behind in the bread, pastry, etc., should be as small and as devoid of medicinal action as possible."

The chemists of the Department have, in some few instances, reported as high as 40 per cent. of starch, and as from 10 to 15 only is necessary, it follows that the excess is in the form of an adulterant.

Such powders are composed of two distinct classes of elements, one an acid and the other an alkali; these two, when moistened, act upon each other and a gas is evolved which produced the effect of making the bread or pastry light and palatable. These two elements only act upon each other in definite proportions, and if more than enough of either is used, the remainder is left as a useless and possibly injurious ingredient in the article of food.

Much has been said and written upon the use of alum as an ingredient of baking powders and scientists appear to be at variance as to its effects. Robinson & Cribb, who are considered as among the best of English authorities, in referring to the use of alum, have the following:

"The objections to the use of alum from a sanitary point of view are that when used in a baking powder, the substance produced by the interaction of the sodium carbonate and alum in the presence of water are:

"1. Sodium sulphate, a well known and powerful purgative, the medicinal dose of which is half an ounce. A quantity equal to five-sixteenths of an ounce would be left from the amount of powder used for one pound of flour.

"2. Sulphate of potash or ammonia, according to whether ammonia or potash alum has been employed. The action of potassium sulphate is that of a mild purgative in doses of 15 to 120 grains.

"3. Alumina, which is the most objectionable ingredient, having the property of rendering insoluble nitrogenous matters and, therefore, indigestible, and also of combining with any phosphoric acid and rendering it also unavailable as food. About 36 grains would be present in one pound of bread made with an alum powder. It is insoluble in water but soluble in the gastric juice, being converted into aluminum chloride. The medicinal dose of alum (dried) is 10 to 40 grains, the larger amounts being given as an emetic."

Another danger in the use of alum which finds a place in the consideration of English courts is the fact that where alum is used in the baking powder or in the bread, an inferior article of flour may be used without its being shown in the product externally.

A leading authority thus alludes to this phase of the question: "Alum, whether added by the miller or baker, makes the bread whiter and more spongy, probably by rendering the glutin more tenacious and less soluble. It is chiefly of advantage if inferior flour is used, and can only be regarded as an adulterant, added to make the purchaser believe that a first class, instead of an inferior flour has been employed. It is only used in small quantities, generally less than 12 grains to the pound of bread (0.15 per cent.) and does not, therefore, appreciably affect the weight or bulk of the loaf."

In England, decisions have been given to the effect that baking powders are not articles of "food," and that they, therefore, do not come under the provisions of the pure food acts. In the case of James vs. Jones, the presiding judge (Hawkins), charged as follows:

"The alum and bi-carbonate of soda used in making bread, assume another form in which, when eaten with the bread, they are injurious to health. The sale of alum is in itself not an offense, even though the seller knows the buyer is going to mix it with bread, and, therefore, the fact that the alum is sold mixed with other things does not alter the position. No one would dream of using the ground rice contained in the baking powder as an article of food, as it is a part of the mixture, injurious or otherwise. One might as well say that poison and flour in equal parts was 'food' because flour is food. The test is whether the article when sold is an article of food or not. Though the pur-

chaser, if he afterwards mixes it with intent to sell, may commit an offense, the vendor would not be committing one. We are clearly of the opinion that baking powder is not an article of food, and neither the sale of it nor the admixture of it with an article of food, unless such article is intended for sale, is an offense. For his own use anybody may use it, and that being so, it would seem strange for the vendor to be liable to penalties. We do not, however, mean to convey it as our opinion that nothing can be deemed to be an article of food unless made up into eatable or drinkable form, such as flour, butter, salt, mustard, pepper, etc., etc., for although no one would dream of eating them alone, yet they are intended to be consumed by mankind."

In referring to this decision, Robinson & Cribb write thus:

"The argument of Hawkins, J., seems inconsistent, for it is certain that baking powder is intended for and used in the preparation of food as much as salt, which he seems to think would come within the limitation of the food and drugs acts. Indeed, so exclusively is baking powder used for preparing articles of food, that it cannot be said that it is intended for any other purpose, and the grounds of the above decision seem equally applicable to mustard, flour or salt, which are all used extensively for purposes other than food, or to pepper or yeast. There are but few articles of food which are not used for other purposes by some persons, and if the act is to achieve its expressed object, it must have been intended to cover articles commonly or usually used for food, which baking powder certainly is."

ADULTERATIONS IN MASSACHUSETTS.

The reports of the Board of Health of Massachusetts inform us that the adulteration of milk, as found from samples sent by inspectors of the Board, has been as follows:

Number of samples of milk examined, ...	4,484
Number of samples above the standard, ...	2,904
Number of samples below the standard, ...	1,580
Percentage of adulteration or deficiency, ...	35.2

Of samples of other kinds of food, not milk, the Board reports the following:

Number of samples of other kinds of food, ...	3,368
Number of samples above the standard, ...	2,978
Number of samples below the standard, ...	390
Percentage of adulteration, ...	11.6

The report of the secretary calls attention to the fact that these figures do not fairly represent the amount of adulteration in the State, in the following language:

"Attention has already been called, in previous reports, to the fact that the percentages given in the foregoing summary do not represent, in any degree, the actual ratio of adulteration existing in food products and in drugs, for several reasons, chiefly on account of the fact that the experience of the board enables it, first, to exercise a careful selection of such articles as are liable to adulteration; secondly, to obtain such articles in those seasons of the year when their adulteration is most common, and, third, to pay special attention to the new forms of adulteration which are constantly appearing as fast as the fraud and ingenuity of the prefessional adulterator presents them to the public."

According to the report above alluded to, 18 out of 67 samples of lard were shown to be adulterated by the addition of cotton-seed oil and tallow. Of 33 samples of olive oil, 10 were composed wholly or in part of vegetable oils, mainly cotton-seed. Of 137 samples of molasses examined, it was found that 12 contained glucose and that the maximum adulteration was 70 per cent. That of 65 samples of honey, 10 contained more or less glucose, the worst sample showing 75 per cent. of the adulterant. Of 22 samples of maple sugar, 7 contained more or less amounts of crude cane sugar, and of 28 samples of maple syrup, 10 contained more or less glucose and sugar house drips. Of 57 samples of cayenne pepper, 23 were found to contain corn, wheat, turmeric, ginger or gypsum, the greatest amount of adulteration being 50 per cent. Of 222 samples of ginger, 38 were found to contain corn meal, turmeric and other cereals, the greatest being 70 per cent.

The tabulated reults of analyses made by the Board, present the following percentages of adulteration:

Summary of Food Statistics.

Foods.	Genuine.	Adulterated.	Total.	Per cent. of Adulteration.
Allspice,	129	6	135	4.4
Butter,	349	0	349	0.0
Canned goods,	44	3	47	6.4
Cassia,	243	7	250	2.8
Cayenne,	44	23	67	34.3
Cheese,	57	0	57	0.0
Chocolate,	30	9	39	23.0
Cloves,	225	10	235	4.3
Coffee,	104	16	120	13.3
Confectionery,	123	3	126	2.4
Cream of tartar,	404	17	421	4.0
Ginger,	184	38	222	17.1
Honey,	55	10	65	15.3
Lard,	49	18	67	26.8
Mace,	12	1	13	7.7
Maple sugar,	15	7	22	31.8
Maple syrup,	18	10	28	35.7
Miscellaneous,	141	49	190	25.8
Molasses,	125	12	137	8.8
Mustard,	141	73	214	34.1
Nutmeg,	11	1	12	8.3
Olive oil,	23	10	33	33.3
Pepper,	315	22	337	6.5
Syrup,	0	3	3	100.0
Tea,	95	1	96	1.0
Vinegar,	42	41	83	49.4
Totals,	2,978	390	3,368	11.6

SUBSTITUTION AND ADULTERATION.

One of the special agents of the Department while examining the stock of grocers doing business in one of the towns in the southeastern portion of the State, found what he believed to be articles of adulterated olive oil, which have been offered for sale and sold. Samples were sent to the chemist, who reported that they were composed wholly of cotton-seed oil and that no olive oil was present. Suits were brought against all in whose possession the article was found, and verdicts rendered in favor of the Department. The defendants then entered the plea that substitution was not adulteration and that the verdict should be set aside. In his opinion, the judge made the following rulings:

"As there was no evidence of the sale of an adulterated article of food, but, at most, an imposition or deception, the sale of one article under the name of another, and as the prohibition contained in clauses two and four of the third section are clearly not within the act as expressed in its title and, therefore, unconstitutional, the verdict must be set aside and the defendants discharged."

In defining the word "adulteration," the judge used the following language:

"While the meaning of words depends upon popular usage, the Legislature has the right to prescribe legal definitions of its own language. But admitting this right, do not the legislative definitions quoted introduce into the body of the act new and additional subjects, not clearly or at all expressed in its title, and thus violate the third section of article three of the Constitution? Both, it is true, relate to food, but the title of the act is not to regulate the manufacture and sale of food but is restricted to food of a certain character, namely, adulterated food, which the article sold in this case was not."

Realizing that the question involved was one of the greatest importance to the purchaser of food products, and further that the question was one which, if permanently decided against the Department, would effectually nullify the effects and results of the pure food law, the case was, by an amicable arrangement of counsel, appealed to the Superior Court and came up for a decision on April 19, 1897.

Judge Orlady, in handing down the decision of the Superior Court, uses the following language:

"The defendant sold cotton-seed oil in packages labeled olive oil and defends his conduct as lawful because the act of June 26, 1895, known as the pure food law, is misleading in that the title does not invite an examination of the body of the bill in which the offense charged is defined as an adulteration.

"The title to this act 'To provide against the adulteration of food and providing for the enforcement thereof,' would naturally invite inspection by any one engaged in the manufacture and sale of food and desirous of knowing what was to be avoided in the making and trafficking in the multiform food products of the day.

"The attempt to defraud the public in selling cotton-seed oil under the guise of a higher priced article of an entirely different name is one of the many similar acts which necessitated the pure food law, and useful and honest legislation should not be defeated by too rigid an adherence to the letter of the Constitution, or pretexts be caught at to avoid legislation when it can be fairly reconciled within constitutional limits. It is a cardinal rule that all statutes are to be so construed as to sustain, rather than ignore them, to give them operation, if the language will permit, instead of treating them as meaningless and invalid.

"The title does not mislead, as it invites examination by the very

words used 'To provide against adulteration of food and providing for the enforcement thereof,' which reasonably embraces every food product, the different classes, kinds, modes of manufacture, and as it was a proper subject for legislative action, all persons whether manufacturers or dealers, are attracted by the words of the title to a critical examination into the provisions of the bill.

"We do not agree with the reasoning of the learned judge below and think that the title to this act gives notice of the provisions of the act so as to reasonably lead to an inquiry into the bill.

"The assignments of error are sustained. The decree of the court below is reversed and the record remitted for further proceedings thereon."

There is probably no one article of food products which gives the Department more trouble than that of substitutes for coffee. In many cases those who mix the articles claim the right, under the provisions of the proviso to section second, which permits the use of the words "compound," or "mixture," under certain conditions and in certain cases. Thus, we have had on the market "substitute coffee," "coffee compound" and "compound coffee," which all contained more or less chicory, burned peas, grains or other similar materials.

The Department decided that coffee was not a product that admitted of compounding with any adulterant or cheaper article, and that a "compound coffee" could legally contain nothing at all but coffee, and that while it might very properly be composed of a mixture of different kinds of coffee, the manufacturer had no right to add chicory or any other material not coffee.

After consideration, Major Wells, Dairy and Food Commissioner, was requested to obtain the opinion of the Attorney General as to the propriety of the Department permitting the use of such misleading labels. A portion of his decision is as follows:

"Acting upon this idea, certain labels containing the words 'coffee compound,' and showing that it is a mixture of prime coffee, English chicory and choice grain, are exhibited for the purpose of securing your approval so that this 'coffee compound' may be sold in our State without interference from those in charge of the enforcement of this law.

"I have no hesitancy in saying that if such a preparation can be sold under the law as coffee, the label is sufficient under the proviso above named. But I am of the opinion that the proviso does not cover an article of food known as 'coffee compound,' such as is intended to be sold by this firm, and that any manufacture for sale, offering for sale or selling of the same as an article of food would be in violation of the very letter and spirit of the act referred to.

"Section 3 of the pure food law defines what an adulteration is within the meaning of the act of Assembly. Any article of food shall be considered adulterated, '1. If any substance or substances have

been mixed with it so as to lower or depreciate or injuriously affect its quality, strength or purity. 2. If any inferior or cheaper substance or substances have been substituted wholly or in part for it. 3. If any valuable or necessary constituents or ingredient has been wholly or in part abstracted from it.' These are but three of the seven kinds of adulteration named in the act. Either of these three definitions is sufficient to brand the 'coffee compound,' offered for sale by the above named firm, as an adulteration. The addition of chicory, wheat, rye or peas to coffee depreciates its 'quality, strength and purity.' It is a substitution, in part, of a cheaper substance to take the place of coffee, and it could very properly be said that in such a compound a valuable constituent has been in part abstracted, for part of the coffee is taken away, and a cereal substituted therefor. If the 'quality, strength or purity' of coffee can be thus depreciated under the authority of the proviso to section 3 of the above act, then is the pure food law a legislative dream. If this cannot be done, then any adulterated article could be sold by simply marking it a compound or mixture. Allspice ground with buckwheat hulls, or cinnamon with hemlock bark, could then be labelled 'compound' and sold in the open markets as such. Such a construction would render the act of 1895 a nullity.

"The pure food law was intended to provide against the adulteration of articles of food, and to prevent deception and fraud in the sale thereof. The legislation was much needed, and it should be enforced in such a way as to give the greatest security to the public consistent with the requirements of the act. It is true that that proviso to section three, above mentioned, says that it 'shall not apply to mixtures or compounds recognized as ordinary articles or ingredients of articles of food.' It is difficult to give any general definition of an 'ordinary article of food' that would apply in all cases. It is, however, a fair presumption that no article of food, adulterated within the meaning of the definition of section 3, is intended to be exempted by the proviso. The proviso is designed to cover a different class of cases. Any one relying upon the proviso to exempt him from the penalties of the law takes upon himself the laboring oar and the burden of proof is upon him to make out the exemption claimed. What is an 'ordinary article of food,' within the meaning of the proviso, must depend upon the facts in each particular case. I am clearly of opinion, however, that coffee, adulterated by the addition of chicory, wheat, rye or pea is not an 'ordinary article of food' intended to be exempted from the penalties of the law. On the other hand, it is an adulteration and cannot be sold without offending against the provisions of the pure food law."

COLORING MATERIALS IN FOOD.

The decision of the Department as to the use of salts of copper for coloring canned peas has, we believe, not only met with the endorsement of a large proportion of those who handle this article, but it has also driven the canners to so mark the packages that the purchaser may know that he is buying goods colored with copper, or they have omitted coloring matter entirely.

The use of coloring matters in food is thus alluded to by the celebrated English authorities, Robinson & Cribb:

"From the point of view of health the subject certainly merits attention. Happily, here in England, the poisonous mineral coloring matters containing iron, lead, copper, arsenic and zinc are rarely if ever met with in foods, their places being taken by the analine dyes. Very few of these are absolutely poisonous, but a not inconsiderable number contain, or are liable to contain, arsenic, mercury or other dangerous impurities, and those who employ these colors have neither the power nor the desire to test them. The analine dyes need only be used in very small quantity owing to their high tinctorial power, so that poisoning can result only from the continued use of the dyed article; for the same reason, the identification and estimation of the dye employed becomes extremely difficult, and, indeed, in many cases impossible. That, in spite of the small quantities likely to be employed, dangerous effects may follow the consumption of dyed food seems plain from the fact that most Continental nations have laws dealing with the subject in the most detailed manner, and applying not only to the coloring of foods and drinks but to many other articles also. Thus, the French regulations enumerate a long list of colors that may be used, and another shorter one of those that may not. In Germany, the use of certain specified unwholesome colors is forbidden for foods, drinks, cosmetic and toys and for vessels, wrappers and covers intended to contain foods. Under certain circumstances, where a poisonous effect is not likely to follow, as when metals are used from glazes and enamels, exceptions are made. Even the use by printers and lithographers of metallic colors containing arsenic is forbidden under certain conditions, and there are special provisions applying to water-color paints. Directions for the examination of foods and drinks are published in an appendix to the law.

"In Italy the manufacture and sale of vessels intended to contain any article of food or drink, coated with anything likely to render the contents harmful is expressly forbidden, and one of the state depart-

ments, in conjunction with the minister of the interior, is authorized to issue a list of injurious and, therefore, forbidden colors, the employment of which in the preparation of food, drinks, toys and articles of domestic use is also prohibited.

"In Milan, according to municipal regulations, no coloring matter of any kind may be added to naturally colored articles of food and drink, such as wine and wine vinegar, fruit, and fruit juices, preserved fruits, and vegetables: further, for articles of food which are openly and admittedly tinted, such as confectionery, the use of the colors mentioned in the German laws as unwholesome is forbidden, and a further list of coal-tar colors is given which may be used, all others being prohibited.

"In Austria-Hungary the laws are still more stringent. Lists of harmful and harmless colors for painting toys and for sweets are given; also short lists of dyes permissible for foods and for show pieces prepared by confectioners and not intended for consumption, and no other colors may be employed or even kept in stock in the warehouses or factories where such goods are either made or kept. Certain specified colors may only be used when protected by a glaze or varnish, and, broadly speaking, the employment of any color dangerous to health for food, table and culinary ware, clothing and toilet requisites are forbidden. In 1886, further regulations were drawn up forbidding the use, for edibles, of any coloring matter produced by the treatment of aniline or other coal-tar derivities, and the whole question is gone into with a minuteness which shows that it is regarded as one of the most serious importance."

BOILED OR PROCESS BUTTER.

During the last eight months of the past year, the Secretary of the Department was aware that low grade and medium butters offered for sale in Philadelphia, were falling in price. When inquiry was made of dealers and others directly interested in the sale of these grades, the reason given was the increased sale of oleomargarine. Inasmuch as the Department was aware that but little oleomargarine was sold in Philadelphia, and that the sale of this product had been greatly decreased, it became necessary to search for another cause for the changes noted.

The attention of the agents of the Department was called to the question, and special orders given by the Secretary that a cause should be looked for. In a short time the chemist reported the receipt of

samples of butter which, under preliminary examination, gave some of the characteristics of oleomargarine but which, under careful analysis proved to be genuine butter. Further examination developed the fact that certain parties were purchasing rancid and low grades of butter, and, by a patented process (under various names), were able to reduce it to its original oil, wash it with alkaline material, and, to at least a great extent, remove the volatile oils which caused the deterioriation of the article; the oils thus cleansed was again churned with sour milk and an article of butter obtained much better in quality than could have been expected from any other process then known.

Several samples of this "boiled," or "new process" butter were obtained and a number of careful tests made to determine its position under the pure food laws of the State. It was found that some of the samples contained an unusually large proportion of water and a correspondingly low proportion of butter fat, and it was supposed that it it could be ruled out of the market on account of this adulteration.

In order to determine the exact status of this article and at the same time obtain the necessary data for the establishment of a theoretical standard for butter, and give the Department data which would enable it to meet the question of a butter standard when it came before the Legislature, one of the chemists was directed to obtain a large number of samples of butter in the Philadelphia market, and to so grade or divide these sample as to include all the different qualities then in the market.

These grades were established as follows:

No. 1. Highest priced butters.
No. 2. Medium priced dairy butters.
No. 3. Cheap dairy butters.
No. 4. Boiled or process butters.

A careful analyses of a large number of samples of each class enabled Dr. Genth to furnish the Department with the following general results:

Highest priced butters, average analyses, gave the following:

Butter fat,	85.29 per cent.
Water,	11.56 per cent.
Curd,	1.10 per cent.
Salt, etc.,	2.05 per cent.

The highest amount of butter fat found in this class was in sample No. 5, which contained 89.11; the lowest was found in sample No. 65, which gave 81.30 of butter fat.

Medium priced dairy butters Average analyses gave as follows:

Butter fat, ...	86.69 per cent.
Water, ...	9.54 per cent.
Curd, ...	1.36 per cent.
Salt, etc., ...	2.41 per cent.

The highest amount of butter fat found was in sample No. 44, which gave 92.50 per cent.; the lowest was found in sample No. 36, which gave but 81.16 per cent.

Cheap dairy butters: The average analyses gave the following:

Butter fat, ...	84.37 per cent.
Water, ...	11.31 per cent.
Curd, ...	2.22 per cent.
Salt, etc., ...	2.10 per cent.

Boiled or process butters: The average analyses gave as follows:

Butter fat, ...	84.40 per cent.
Water, ...	11.29 per cent.
Curd, ...	1.90 per cent.
Salt, etc., ...	2.42 per cent.

The lowest amount of butter fat was found in sample No. 3, which gave 77.95 per cent., and the highest in sample No. 48, which gave 90.65 per cent.

In order to obtain data for the establishment of a standard of butter fat, a large number of "miscellaneous" samples were tested, and the average result was as follows:

Butter fat, ...	85.30 per cent.
Water, ...	11.23 per cent.
Curd, ...	1.75 per cent.
Salt, etc., ...	1.71 per cent.

If we place the average results of these different grades side by side, we have the following results:

High priced butters, ...	Butter fat,...	85.29 per cent.
Medium dairy butters, ...	Butter fat,...	86.69 per cent.
Cheap dairy butters, ...	Butter fat,...	84.37 per cent.
Boiled or process butters,	Butter fat,...	84.40 per cent.
Miscellaneous butters, ...	Butter fat,...	85.30 per cent.

When the different grades are compared by their water contents, we have the following:

High priced butters, ...	Water, ...	11.55 per cent.
Medium priced butters, ..	Water, ...	9.54 per cent.
Cheap dairy butters, ...	Water, ...	11.31 per cent.
Boiled or process butters,	Water, ...	11.29 per cent.
Miscellaneous butters, ...	Water, ...	11.23 per cent.

The above comparisons show conclusively that "boiled," or "process," butter cannot be ruled out of the market on account of a low percentage of butter fat and a high percentage of water, for, compared by either of these criterions, the showing is favorable to the "process" article, and the fact that, out of the number of samples selected and tested, but four ran below 80 per cent. of butter fat, shows that, if care is exercised in the process, a low rate of butter fat is not a necessary adjunct to this class of butter.

Just what may be the effect of this raid upon the butter market, it is difficult to foretell, but that it already has, and is likely to do so more in the future, held down the prices of low grade and medium butters, cannot be doubted and is apparent to all who have followed up the indications of the market.

One result of these tests is very evident, and this is, that a standard of 80 per cent. of butter fat is a very fair one to the manufacturer of butter and as low as is consistent with the interests of the consumer, and that it is safe to assume that any butter which contains a less amount may be deemed to be adulterated within the meaning of the pure food laws.

SUBSTITUTES FOR COFFEE.

Of the many substitutes now upon our markets, there is probably no one article to which substitution is carried to greater extent, or in which the substitute is as nearly equal the original as in coffee; roasted mixtures of barley and rye, barley alone, barley and chicory and other numerous preparations so nearly approach coffee in their taste that they now almost constitute a class of food by themselves. The extent to which their use has been increased within the past twelve years is shown by the following table showing the consumption and value each year:

	Pounds Sold.	Value.
1884, ...	89,000	$6,000 00
1885, ...	115,000	6,000 00
1886, ...	78,000	6,000 00
1887, ...	111,000	7,000 00
1888, ...	79,000	5,000 00
1889, ...	84,000	5,000 00
1890, ...	137,000	9,000 00
1891, ...	49,000	4,000 00
1892, ...	1,950,000	75,000 00
1893, ...	1,482,000	55,000 00
1894, ...	1,027,000	43,000 00
1895, ...	2,807,000	107,000 00
1896, ...	2,339,000	90,000 00

During the same years the increase in the importation of coffee has increased very slowly, and is shown by the following table:

	Pounds Sold.	Value.
1884, ...	533,000,000	$50,000,000 00
1885, ...	572,000,000	47,000,000 00
1886, ...	566,000,000	43,000,000 00
1887, ...	526,000,000	56,000,000 00
1888, ...	424,000,000	61,000,000 00
1889, ...	579,000,000	75,000,000 00
1890, ...	499,000,000	78,000,000 00
1891, ...	520,000,000	96,000,000 00
1892, ...	634,000,000	127,000,000 00
1893, ...	542,000,000	77,000,000 00
1894, ...	532,000,000	87,000,000 00
1895, ...	656,000,000	97,000,000 00
1896, ...	580,000,000	85,000,000 00

Within the past year a few manufacturers of these substitute coffees have, by some means known only to themselves, been able to imitate the flavor of the leading kinds of coffee in the substitutes and one may now have the "substitute" of almost any common coffee flavor that he may select, and at prices that would have surprised the grocer of twenty years ago.

Some brands which have been examined by the chemists of the Department, composed wholly of roasted grains, principally barley, also have the flavor of Mocha and Rio and of the mixture of the two, but our chemists have not yet been able to tell us how this is obtained.

It is fortunate that, thus far, the officers of the Department have not found a single instance of any injurious ingredients having been used for or in these substitutes. Nearly all have been composed to a greater or less extent of roasted grains, in a very few of which broken corn seems to have been an ingredient.

Of the possible effects of chicory upon the system, Dr. Hassell writes thus:

"It is very certain that an infusion of roasted chicory is an aperient. Coffee exerts on the system marked and highly important physiological effects of a beneficial character. There is no proof that chicory exerts any one of these effects, while it is very doubtful whether the properties which it does possess are not really hurtful."

Robinson & Cribb, in referring to the same topic, have the following:

"From a dietic point of view, chicory cannot be regarded as in any sense a substitute for coffee. It is altogether devoid of caffein, caffeic acid and caffeol, and its flavor is bitter and disagreeable. As regards its active constituents there is said to be a minute amount of essential oil very similar to that of coffee in its effects on the system, and a bitter principle, which is, however, probably caramel and nothing more."

Pereirax (Materia Medica) states that "there can be no doubt that chicory must, when taken largely, have a tendency to excite diarrhoea. It scarcely deserves to be called nutritive since, with the exception of the sugar, it is almost entirely devoid of nutritive principles."

In the work of the Department, under the provisions of the pure food law, these substitutes only attract the attention of our special agents sufficiently to ascertain whether the outside of the package exhibits in sufficiently large and prominent type the words "substitute," or "mixture," as required by law. The tendency of the manufacturer is to so place these words upon the package that the first few times that it is handled the paper wrapper becomes so indented as to prevent the purchaser from seeing the word at all. In the case of whole grain this is not so important, as its character will warn the customer of the fraud which might have been practiced, but where the material is finely ground and more nearly resembles ground coffee, the necessity for care on the part of the special agents of the Department becomes more evident.

There is also much room for fraud in the sale of mixtures of coffee and chicory, both ground, and no doubt there is more or less which escapes the notice of the Department agents and is sold as pure coffee. Robinson & Cribb state that if a mixture of ground chicory and coffee is lightly poured upon water, the coffee will float while the chicory will sink, and the coffee will, if the water is agitated, only color the contents of the glass slightly while the chicory will, as they pass

downward through the water, leave a trail of a dirty, dark brown color.

The effects of coffee are, according to one of our best authorities, due to:

1. Caffein, or theine, which is an alkaloid closely allied chemically to the bromine of cocoa. It is also found in tea, Paraguay or Mate tea, Brazillian coffee and in the nuts of the kola tree found in West Central Africa. In large doses it has decidedly poisonous properties, but in medicinal quantities it increases the strength of the heart's action and acts as a direct stimulant to the nervous system and also as a diuretic.

2. Caffeol, or caffeine, is an oily liquid developed during roasting, almost insoluble in water but readily imparting its odor to infusions. Its action is to quicken the pulse, dilate the vessels and lower the blood pressure and produce a sensation of warmth to the surface of the body.

3. Caffeic, or caffetannic acid, is an astringent substance; is found in tea in much larger amount; also in many other plants.

4. The physiological effect of coffee as a beverage is to induce wakefulness and to produce a feeling of exhilaration by exciting the nervous system, thus counteracting fatigue. It also allays hunger or reduces the demand for food by diminishing the waste and decay going on within the body.

QUESTIONS AND ANSWERS.

BY THE SECRETARY.

At the farmers' institutes held by the Department, a question box is usually kept upon the desk of the Secretary. Questions placed in this box are referred to some one present for an answer. In many cases these questions have been preserved and have passed into the hands of the Secretary of the Department.

The correspondence of the office usually brings with it a large number of questions which are answered by the Secretary from the best data obtainable at the time. All of these questions are here answered, not as they were answered by others at the institutes, nor as they were answered by the Secretary at the time that they were received, but in the light of such data as can be obtained; and the answers are given, not as infallible, but as being the best that could be given with the information at hand.

" *What has been the decrease in the annual rainfall during the past fifty years.* "

Notwithstanding the popular opinion to the contrary, there is no proof that there has been any decrease in our rainfall during the period named in the question. On the other hand, we think that it would be easier to obtain evidence of an increase than a decrease. The trouble appears to be that in our estimates we mistake the less even and equal distribution of the rainfall of a decrease, and that we remember the dry periods better than we do those made notable by an increased amount of rainfall.

The records, if they show any change at all, seem to show a slight increase; but after a somewhat extended and careful investigation, we are of the opinion that the average annual rainfall has not varied much if periods of ten years are taken, it being manifestly unfair and unsafe to take much shorter periods of time. We have the records for 66 years before us, and, dividing them into time periods of five years each, we find the following figures to be correct:

First period of five years, ...	41.47 inches.
Second period of five years, ...	40.92 inches.
Third period of five years, ...	46.20 inches.
Fourth period of five years, ...	44.00 inches.
Fifth period of five years, ...	42.47 inches.
Sixth period of five years, ...	42.28 inches.
Seventh period of five years, ...	47.72 inches.
Eighth period of five years, ...	45.83 inches.
Ninth period of five years, ...	47.50 inches.
Tenth period of five years, ...	47.50 inches.
Eleventh period of five years, ...	34.47 inches.
Twelfth period of five years, ...	37.54 inches.
Thirteenth period of five years, ...	51.52 inches.

Inasmuch as the thirteenth period of five years included the unprecedented downfall which caused the Johnstown flood, and which extended nearly all over the State, it should properly be entirely discarded in making up the average.

By dividing the record into periods of ten years we obtain the following averages:

First period of ten years, ...	41.20 inches.
Second period of ten years, ...	45.10 inches.
Third period of ten years, ...	42.38 inches.
Fourth period of ten years, ...	46.78 inches.
Fifth period of ten years, ...	47.50 inches.
Sixth period of ten years, ...	36.01 inches.
Seventh period of ten years, ...	49.63 inches.

"*When Secretary Edge speaks of a certain fertilizer as guaranteed to contain a certain percentage of nitrogen, does he mean that nitrogen actually exists in the fertilizer?*

When a manufacturer guarantees a certain percentage of nitrogen, he means that it contains nitrogen which, if free from any combination, would equal the percentage given; it, however, does not exist in the fertilizer as nitrogen at all. This is best explained by the following by Dr. Collier:

"Nitrogen is a gas, and in that form cannot be used in fertilizers. Therefore, whenever we speak of nitrogen in fertilizers, we do not mean that nitrogen exists in them as a simple nitrogen. As previously stated, the nitrogen in fertilizers is always combined with other elements and may be present in one or more different forms; first, in the form of nitrates as in nitrate of soda; second, in the form of ammonia compounds, such as sulphate of ammonia, and, third, in the form of organic matter such as animal or vegetable, as dried blood, meat, tobacco stems, etc. Chemical analyses, according to official methods do not attempt to ascertain and state in which form or forms the nitrogen exists in a fertilizer. Therefore, the numbers in the columns under "determined as nitrogen" are intended to state simply the amount of nitrogen present, without regard to the form in which it is present or, expressed in another way, how much nitrogen there would be if it were present in the form of pure nitrogen or nitrogen gas."

"*Is it probable that the present low prices of farm stock will continue?*"

The indications now are that we have about reached the lowest prices for horses, but, owing to an actual scarcity, it is quite probable that the prices of feeding cattle will advance for a few years yet; our western farmers have run to "corn" largely and have, in very many cases, sold off their breeding stock. It requires some time to get up a stock of horses and cattle, but sheep and hogs can be increased in a short time.

One of our Western breeders and cattle feeders writes as follows in relation to the future of horses and cattle:

"I see nothing in the near future to justify the extravagant prices now being paid for feeding cattle. That we are short on cattle there can be no question, and we will not be otherwise very soon, but there is no more reason or sense in us riding over one another and paying extravagant prices to get these cattle than there was only a few years ago when we were doing the same thing to get rid of them. How inclined we are as a people to quit a thing when it costs us the most to quit, and go at something else when we must pay high for the privilege

of doing so? The past few years it has been corn, corn, corn; now we want more hay, pasture and cattle. Cattle are all right and will be for some time, but I think the farmer who now begins the breeding of good horses will have as profitable an investment as the farmer who now begins again breeding cattle, and as the cattle and horse breeding business is again revived, the farmer who raises the corn will also do a profitable business. I like horses only for their valued service, but I firmly believe that good two-year colts at the price they can now be bought for, will be a more profitable investment than will be the good two-year old steers at what they are now selling for."

"*Is first class creamery butter shipped to England to any great extent?*"

The most of the first class butter imported into England comes from the northern part of France and is without salt; any butter which is to displace this must comply with the same requirements and be made without the addition of any salt.

Several shipments have been made but thus far the results have not been such as will warrant any great extension of the trade. One lot of first-class creamery shipped from New York reached the English customer in ten days after it left the churn, but the cost of packing, ice, special freight and commissions nearly or quite absorbed the profit on the transaction.

One owner of one of our western creameries shipped two tons of butter as an experiment; when the butter left the creamery it would have sold for 17 cents; it sold, to the consumer in England, for a trifle more than 21 cents.

Several shipments were made indirectly under the care of the U. S. Department of Agriculture. One of these, with the results, are thus described:

"This consisted of a lot of Minnesota creamery in 56-lb. boxes and tubs, and a lot of Massachusetts creamery in small tubs, family packages and fancy prints. The export was made in June. It cost about 2½ cents a pound to carry the butter from central Minnesota to London, by the single ton, with the best refrigerator accommodations all the way, except short transfers. The transportation from western Massachusetts cost rather more, because of the absence of a refrigerator car line to New York, and the necessity of paying expressage. This butter was all placed, in London, in the hands of retail dealers. They paid from 15 to 19½ cents per pound for it, the same butter being then worth 15 cents in New York. The wholesale price of Danish butter was about 20 cents in London. It was all retailed to consumers at 24, 25 and 26 cents per pound, most of it at 26. This was the same as the retail price of the best Danish, which leads the London

market for salted butter. The retailers, on being convinced of the high quality of this 'States' butter, paid the same price for it in tubs as in the favorite 'Australian' or cubical box. Six different dealers took the Minnesota butter at a uniform price of eighteen and one-fifth cents per pound. It cost about 16 cents delivered to these dealers in London. The Massachusetts butter was of equal quality and although some of it sold to dealers at 19½ cents, the small packages were not liked. This butter was worth 20 cents for local sale in the neighborhood where made. Thus, as in other cases, the western creamery butter was sold at a fair profit, over 2 cents per pound, while the New England was sold in London at less than it would have brought at home."

"*What does Secretary Edge mean by 'indirect' fertilizers?*"

Fertilizers are sometimes divided into two classes, "direct" and "indirect." A "direct" fertilizer is one which supplies plant food directly to the crop and has but little if any effect beyond the action, as plant food, of the material which it contains; of this class we may instance ground bone, sulphate of potash and nitrate of soda.

An "indirect" fertilizer is one which produces action other than as a direct plant food, which influences materials already in the soil and fits it for plant food. This class is represented by lime, salt and similar materials.

In some cases the application of an "indirect" fertilizer is equivalent to the application of a direct one of entirely a different character. Thus, upon some soils, the application of lime is equivalent to a dressing of potash, because the soil contains a salt of potash in a form not soluble or useful as plant food; the lime breaks up the combination, releases the potash and, at least in some cases, forms new combinations which are often valuable and are "direct" fertilizers, though produced through the agency of an "indirect" one.

The effect of "indirect" fertilizers may be illustrated by a mixture of lime and salt. If the materials are finely divided and well mixed together, two new compounds will, in course of time, be formed, both formed by an interchange of elements in the two original articles used. The alkali (lime and salt) change bases and form new forms of plant food.

It is claimed that the results which follow the application of common salt are those of an "indirect" fertilizer, the salt acting upon materials already in the soil, breaking up combinations and forming new and more valuable ones.

In its effects upon humus and decaying vegetable matter in the soil, lime affords an excellent illustration of an indirect fertilizer. The benefits derived from this application cannot be ascribed to the direct

action of lime as a plant food and can only be attributed to its action in forming new compounds and releasing otherwise insoluble matter in the soil.

"*How much salt should be used for one pound of butter?*"

This depends very much upon the market, some requiring double the amounts used in others. The best butter offered in the English market comes from France and salt is not used in it at all, and its use would condemn the article for the best customers.

The amount also depends upon the stage in the manufacture of the butter in which it is applied. An amount which is proper if added after the butter has been partially worked would be inadequate if added as soon as the butter is taken from the churn. An amount applied after the butter had been well washed would fail to give satisfaction if added before washing.

Philadelphia trade appears to require nearly one ounce to the pound if added after the butter is taken out of the churn, or one-half that amount if added after the butter has nearly all of the buttermilk and water worked out.

The addition of salt to butter is a question of taste, and it is manifestly the proper thing for each butter maker to ascertain what best pleases his customers and then follow that rule.

In New York there is a trade springing up for unsalted butter, and it is claimed that within a few years salted butter will be the exception of the city markets.

"*Does the use of commercial fertilizers pay?*"

Taking the data for the answer from our own observations, we might readily answer it either in the affirmative or the negative, but will give the following affirmative answer by D. C. Lewis, of Cranberry, New Jersey.

Previous to the application of the fertilizers or the commencement of the experiment, an 18-acre field had the following treatment:

In July, 1893, it was covered by 144 loads of manure, or at the rate of 8 loads per acre; in 1894, it was plowed for corn and 200 pounds of corn fertilizer per acre drilled in with the seed. The yield was 45 bushels per acre and the value of the corn and fodder was estimated at $24.55 per acre, or a total value of $441.90 for the whole field.

From this point, following Mr. Lewis' account, we have the following:

"In 1895 the corn stubble was plowed and the field was planted to potatoes, using 1,000 pounds of fertilizer per acre. The yield was over 5,000 bushels, which sold at a very low price. Including the esti-

mated value of the small potatoes fed to the stock, the crop brought $1,102, while the cost of the fertilizer was $473.40.

"As soon as the potatoes were dug, the field was worked up and sown to wheat, with 400 pounds of fertilizer per acre. The wheat gave 34 bushels per acre and sold at 73 cents per bushel. This gave an income of $446.76 for the wheat, while the fertilizer cost $136.80.

"In 1897, this field is in grass, and has given not less than 2¾ tons of hay per acre, which, at $8 per ton, represents $396. The second cutting of the grass, in 1898, will give at least two tons per acre, which, at the average price of $10 per ton, will bring $36. All this gives us the following statement:

	Income.	Cost of Fertilizers.
1894. Corn crop,	$441 90	$72 00
1895. Potato crop,	1,102 00	473 40
1896. Wheat crop,	446 76	136 80
1897. Hay crop,	396 00	....
1898. Hay crop,	360 00	....
Total,	$2,746 66	$682 20

"In other words, during the five years' rotation, the cost of fertilizing for this 18-acre field averaged $136.40, or $7.58 per acre for each year. The sales from the field averaged $549.33, or $30.52 per acre for each year. This leaves an average margin of $22.94 per acre to pay for seeding, labor, interest and other expenses through the whole rotation.

"We take the five different crops in this way since, under this system, it is hardly fair to figure any single one. The fertilizer for the potato crop cost $473.40, or $26.30 per acre, yet by rights that should be divided by three, since it has also produced two crops of grain. This year's expense in the hay field will be but the cost of cutting and handling, yet it would not be fair to say that the hay cost nothing for fertilizing. In a rotation of this sort, one crop works into another and helps it out, so that it is difficult to figure on the cost of any one crop."

"*Is the analysis, as branded upon fertilizer sacks, found to be generally reliable?*

During the past year over 1,400 samples of commercial fertilizers were selected by the special agents of the Department and sent in for an official analysis. The result clearly shows the benefit of the law as to the average sample, but no attempt was made to ascertain how many were below the guaranteed analysis. We may, however, take the results of similar analyses at the Hatch Experiment Station,

in Massachusetts, as a criterion. These, when tabulated, show the following results:

1. Complete fertilizers, or those containing three ingredients, nitrogen, potash and phosphoric acid:

With elements equal to or above highest guarantee,	3
With two elements above highest guarantee, ...	18
With one element above highest guarantee, ...	65
With three elements between highest and lowest guarantee, ...	26
With two elements between highest and lowest guarantee, ...	60
With one element between highest and lowest guarantee, ...	42
With two elements below lowest guarantee, ...	8
With one element below lowest guarantee, ...	59

In our experience in this State we usually find that where one or two elements fall below the other, one or two are found to be above the guarantee, but this is not always the case.

2. Fertilizers containing but two elements as, for instance, ground bone, phosphoric acid and nitrogen, or alkaline fertilizers with potash and phosphoric acid:

With two elements above highest guarantee, ...	3
With one element above highest guarantee, ...	16
With two elements between highest and lowest guarantee, ...	13
With one element below the lowest guarantee, ..	10

3. Fertilizers with but one element, as South Carolina Rock:

Above highest guarantee, ...	4
Between highest and lowest gaurantee, ...	21
Below lowest guarantee, ...	11

In this connection it should be remembered that the lowest figure of the analysis is all that is really guaranteed to the purchasers.

"What is the meaning of the words 'total phosphoric acid,' as placed upon bags of Acidulated South Carolina Rock?"

The only reason that can probably be given for their use is that manufacturers find that a certain class of purchasers prefer these brands which have a large amount of lettering upon the bags, and thus endeavor to satisfy the purchaser.

Practically, there is need for but one line upon the analysis of Acidu lated South Carolina Rock. If the manufacturer would brand the

"available phosphoric acid" it would answer every purpose and be less confusing to the average purchaser. The only objection to this is that the law requires that both "soluble" and "reverted" phosphoric acid shall be placed upon the sacks. These two added together make the "available," but under our system of valuation, have different prices per pound. Some manufacturers appear to try to confuse the purchaser by adding much to the brand that is useless. Thus, we often find the following upon bags of this class of fertilizers:

Soluble phosphoric acid, ...	8 to 9.
Reverted phosphoric acid, ...	3 to 4.
Insoluble phosphoric acid, ...	2 to 3.
Total phosphoric acid, ...	13 to 16.
Bone phosphate of lime, ...	24 to 28.

By adding the "soluble" and "reverted" phosphoric acid of the above analysis together, we have "available" phosphoric acid, 11 to 13, and this is all that the purchaser cares anything about, and, practically all that is of value which he obtains in his purchase. The "insoluble" phosphoric acid is of comparatively no value; the "total" phosphoric acid is obtained by adding the other three kinds together, and, hence, is but a repetition, and the "bone phosphate of lime" is, in another form, but a repetition of the "total" phosphoric acid. Hence, the words "available phosphoric acid, 11 to 13" are all that are really necessary as a guide to the buyer and all else is but liable to confuse him and lead him astray, the object being, of course, to increase the apparent value of the fertilizer in the estimation of those not well versed in analyses.

"*Have not the surroundings and ventilation much to do with the spread of tuberculosis?*"

Of course, this disease cannot be created; the germ must first exist, but its existence does not necessarily mean the infection of the herd of animals in the herd. If the surroundings are perfect, if ventilation is good, if the animals are well fed, it is possible, in very many instances, in fact in a majority of them, that the vitality of the animal may throw disease off, but if, on the other hand, the stables are dark and poorly ventilated, if the animals are scantily fed or if fed upon an improper kind of food, the disease, even under similar circumstances, may and usually will spread with great rapidity.

One of the worst outbreaks which came under the care of the Board of Agriculture was one in which the animals were fed on the best food that could be procured; were curried once each day and some of them were milked three times; the stables were warm and comfortable. but all ventilation, during cold weather, had been cut off by closely stopping up the funnels, windows and doors.

In alluding to the recent attempts of Count Wedell, of Denmark, to clear his herd of this disease, the "London Field" has the following:

"Mr. Wedell is following in the wake of Prof. Bang's teachings; he is determined that his herd shall be composed of animals that are free from the disease; he recognizes the danger to the farmer of loss; it may be ruin which follows on the spread of tuberculosis, yet he resides upon a thinly inhabited island. Out of something like 300 head of his cattle, a large proportion have reacted after the tuberculin test; in other words, the rise in temperature has shown that they were infected with the disease, insignificant as in many cases the lesions may be. The animals which react are not slaughtered or sold, but are simply housed apart, fed by separate sets of men and grazed on separate fields. The tests are made twice each year, and Count Wedell has every hope that by following this plan unremittingly, he will, in a few years, be able to show a clean bill of health."

Prof. Bang's theory is that, even after the animal has been actually infected, it may throw off the disease if kept in the open air, with good food and care. If this is correct, and the evidence at hand indicates that it is, it is very evident that ventilation has much to do with not only the spread of the disease, but also with the infection.

"*Does it pay the farmer to store his grain for higher prices?*"

Holding grain for higher prices partakes more or less of the nature of speculation, which is not intimately connected with farming, and we think it will be found that if the average of fifteen or twenty years is taken, that holding grain for higher prices does not produce sufficient profit to make it pay.

Secretary Bonham, of the Ohio Board of Agriculture, when asked "What is the gain in selling new wheat from the thresher at 75 cents over keeping it four months and selling it for 80 cents?" replied as follows:

"When the granary is so tight as to protect against loss by vermin or thieves, it is safe to count on taking out as many pounds in February or March as was put in in August or September. The factor, however, that has concerned me more, is the labor. I have sold from the thresher, hauling direct to the elevator, and have stored it in the granary and for a short time on the barn floor, when I could not get teams enough to haul to the elevator as fast as it was threshed. Keeping an accurate account of the cost of the two methods, I have concluded that there is a saving in labor of five cents per bushel by hauling at once to the elevator. Unless one is sure of more than five cents advance, it is better to haul grain to market as it comes from the thresher, when we thresh from the shock or stack."

PRICES OF WHEAT AT PHILADELPHIA, 1897.

"In his remarks this morning in relation to tuberculosis, Secretary Edge alluded to the possibility of immunity of some animals; what did he mean?"

It is well known that in all disease caused or produced by germs the different classes of animals are not only affected differently, but that they are liable to infection in very different degrees, and it is also well known that some germ diseases are practically confined to certain kinds of animals. Of this we may instance the disease called contagious pleuro pneumonia; this was confined to cattle, and horses were never known to be affected by it; goats were affected but pigs were not; rabbits were liable to it but many other classes of animals were in some manner protected from it. Although not admitted by all, yet practical evidence seemed to prove that animals which were once infected by this disease and had recovered had in some manner obtained an immunity and were not subject to re-infection.

Not only does a change in the character of the animal appear in some cases to confer immunity, but even among those which are liable the infection takes place to a variety of degrees. Thus, Prof. Nelson writes: "The number and strength of the germs that enter at once or the frequency with which the infection is repeated, as related to the power of the body to resist invasion, is important. The rabbit, for instance, not so susceptible to tuberculosis as the guinea pig, will usually not become tuberculous if the germs that are innoculated have been heated to 140 degrees F., or if they are fewer in number than 150."

When it is remembered that simply raising the temperature to 150 degrees for a short space of time will not destroy the germs so as to prevent infection of the human and bovine races, this variation becomes apparent and plain.

In referring to another source of immunity, Prof. Nelson writes as follows:

"In the case of several diseases (questionably so with tuberculosis) recovery from one attack confers immunity against a subsequent attack. If the blood of an immune animal is innoculated into a susceptible one, it will render the latter immune. When a patient recovers from a disease it is supposed to be due to the fact that his tissues have manufactured an antidote to the bacterial poison, or a counter poison called anti-toxin, which has a repressing or attenuating action upon the germs. By cultivating germs under artificial conditions, they become so changed as to make a weakened poison. These "attenuated" germs, when innoculated or vaccinated into the animal, produce a mild form of the disease, under the stimulus of which the body acquires immunity against stronger attacks."

"*Is there any plan by which grapes can be successfully kept in a fresh state?*"

The agricultural papers contain numerous plans for effecting this result, and reports indicate that they are none of them successful for any great length of time. One plan which is said to be one of the most successful, is to select only the soundest and best bunches, carefully dip the end of the stem in resin or wax and hang each up in a cool room so that they do not touch each other.

The California Experiment Station, in one of its reports, gives the results of several experiments in this direction, from which the following condensed summary is taken:

"In saw dust grapes kept well for a month but began to decay in six weeks, and at the end of two months were unfit for use. At all times those not injured by decay were seriously injured by a peculiar taste when taken from the saw dust, and the plan was not deemed as successful as that of hanging the bunches in a dark and cool room.

Grapes treated with alcohol vapor and sealed up in a box, the sealing having been done with paraffin, kept their appearance for five months. At the end of nine months many had fallen off the stems and the white ones had turned brown. Those which were otherwise fit to eat were more or less injured by the taste of the alcohol vapor. By dipping the bunches in a weak solution of sulphuric acid before exposing them to the alcohol vapor, did not give much better results, except that a lower percentage changed color.

Grapes which had been sterilized by sulphur fumes and then kept in an atmosphere of carbon dioxide kept well for nine months, but at the end of that time had moulded somewhat; those kept in an atmosphere of sulphur fumes were apparently in about as good condition as those treated with carbon dioxide, except that the black varieties turned brown."

In summarizing the experiment, the following language is used:

"These experiments, although in no case successful in preserving grapes in a perfectly marketable condition, are very promising, and show that at least their appearance can be kept perfect. They show also the ease with which grapes, under the conditions in the experiments took up odors, and the necessity of keeping them protected from anything that is liable to give them a bad flavor."

"*How much water should there be in butter?*"

There is no law upon the statute books of our State which fixes the minimum of water which may legally exist in butter, and we presume that in case of a law suit, expert evidence would be taken to fix this minimum. We believe that English law fixes a minimum of 14 per cent. of water, but it is also stated by good authorities that it is im-

possible to convict upon less than 16 to 18 per cent., and in some localities with less than 20 per cent.

A short time ago complaints came to the Department of Agriculture that "American" butter sold in Europe contained too much brine for the English market; this complaint led to an investigation, and the following table shows the result of several analyses of "American" and English butter, showing the butter fat as well as the water:

	Per Cent. Water.	Per Cent. Butter-fat.
Minnesota creamery,	11.47	86.63
English Dorset,	15.00	83.69
Brittany rolls,	15.36	83.70
Irish creamery,	14.63	79.54
Kansas creamery,	8.34	90.43
Kansas creamery, No. 2,	8.95	89.05

An English authority gives the following as the usual ranges of English butter:

Water,	8 to 14 per cent.
Fat,	80 to 88 per cent.
Curd (casein),	0.5 to 3 per cent.
Salt,	0.5 to 5 per cent.

Dr. Bell writes: "a greater amount of water than 12 per cent. is unnecessary so far as attaining a good appearance is concerned, and anything over 16 per cent. is injurious to the keeping qualities of the butter." Robinson & Cribb state that "certain substances are said to be added to butter to facilitate the incorporation of very large quantities of water; rennet, and, in America, a mixture of sodium sulphate and pepsin has been used. As much as 40 per cent. of water, it is said, has been added to the butter without its presence becoming noticeable to the ordinary observer."

"*Is there no simple and inexpensive plan by which oleomargarine can be detected?*"

Not with sufficient certainty to go before a jury, in a case against a manufacturer or seller of oleomargarine. But it is claimed by one or more of the special agents of the Department that they have inexpensive tests by which they can, in a majority of cases, tell whether the sample is oleo or not.

In France, Mons. Elvire, an inspector of food products, gives the following rules:

"1. Melt the butter to 95 degrees Fahrenheit; if it is pure the liquid is perfectly clear; if it is mixed and much more cloudy, it contains margarine.

"2. Filter the melted butter through a piece of flannel. If the butter is pure it passes through like water through a filter; if it is mixed it is much harder to pass through and falls drop by drop.

"3. To the product thus filtered add a soluton of nitrate of silver; shake it and plunge the tube in boiling water. If it is pure the mixture remains as it is; if a fraud it becomes a marine color, which, according to the quantity of margarine contained in it, turns the color of beer or coffee. This reaction discloses the presence of vegetable oil, margarine being composed of oleomargarine or an extract of animal fat, milk and vegetable oil.

"4. Finally, the oleomargarine is tried by the aid of an instrument called an oleo-grammetre. This instrument is composed essentially of a metallic stem, which is placed in the melted butter, to which has been added a little sulphuric acid. It is then left to get cool for an hour, until it is at 71 degrees Fahrenheit. If the butter is pure, the tube will sink by reason of its own weight to the bottom of the vessel; if it is not pure, the tube will not sink."

"*Is there no remedy or cure for tuberculosis?*"

A satisfactory answer to this question is very difficult; our thinking men in this country and in Europe are arriving at the conclusion that if there is no remedy, that much might be done in the line of prevention, and that, instead of large expenditures for animals killed, it might be profitable to test the matter of preventing and possibly the cure of light cases. It will be remembered that the use of tuberculin for the discovery of the disease originated in the experiments and tests of Koch, who claimed to be able to cure the disease by injections of the tuberculin. This did not prove to be the case, but the evidence now adduced shows that there was in reality more in Koch's theory than has been supposed, and experiments tried for that purpose appear to demonstrate that repeated injections of tuberculin will encyst the tubercules and render them harmless, at least for the time being, if it does not in reality cure the disease.

The members of our State Live Stock Sanitary Board have been so much impressed with this and other facts brought out by carefully conducted European experiments that they, at the last session of our Legislature, asked for and obtained an appropriation for the purpose of making a careful test of the means of prevention and possibly of cure (should there be such found), and experiments are now under way for the purpose of ascertaining what there is in the various theories which have been developed within the past year.

It is evident to all practical dairymen that the treatment which we now accord to our cows is well calculated to cause heavy losses from this disease, and that while no one can, for any length of time, claim that bad sanitation will cause the disease, yet it is undoubtedly the fact that bad sanitary surroundings are responsible for much of the loss now overtaking our dairy owners. Bad ventilation, high feeding, constant milking and the unnatural condition in which our cows are kept certainly have much to do, as all the members of our Stock Board fully believe, with the present condition of affairs, and it is their intention to see what the effects of the best sanitary surround-their intention to see what the effects of the best sanitary surroundings will have upon slight cases of tuberculosis, and they hope to be able to show conclusively that with animals of high value at least, it may pay to isolate them and give them the best possible opportunity to throw off the disease.

" *What is the cost of milk?*"

It depends upon at least three factors, the man, the cow and the feed; and error in any one of these may and will very materially increase the cost of the milk. The man, by improper management or feeding may double or halve the cost of the milk. Improper food may double its cost; poor cows may and often do more than double the cost of their product.

A large milk producer in New York writes thus:

"The poorest cow that I ever owned gave 1,000 quarts a year at a cost of over five cents, while another cow produced over 7,000 quarts at a cost of less than three-fourths of a cent a quart.

"A year ago the food cost per cow per day was 26.15 cents. Of this the farm furnished 8 cents and 18.15 cents was purchased. On this expense, the herd averaged 14 quarts a day, at a cost of 1.86 cents per quart. The ration was 12 pounds of hay, 8 pounds of corn fodder, 10 pounds of wheat bran, 6 pounds of hominy and 3 pounds of cotton-seed meal.

"An effort was made to reduce the cost by better study of the feeding questiön, and the following ration was adopted: 20 pounds of hay, 3 pounds of oats straw, 3 pounds of oats, 6 pounds of wheat bran, 4 pounds of buckwheat middlings and 2 pounds of cotton-seed meal. This ration cost 21½ cents per day. Of this 10 cents was raised on the farm and 11 cents purchased. The milk increased to 15.14 quarts per day, making the cost per quart 1.4, a saving of over three-quarters of a cent per quart per day. In 1895 my cows averaged 1,000 quarts per cow and the milk cost me 2.8 cents per quart. Last year the yield was 3,754 quarts per cow. This result was brought about by weeding out the poor cows and putting good ones in their places. To know

the good from the bad, the milk of each cow was weighed and tested at regular intervals. 'I guess so' was discharged and 'I know so' put in his place."

Ex-Governor Hoard, in an address at an agricultural meeting, spoke thus: "There are 800 patrons of the Hoard creameries. Among them, at each of the ten creameries are men who produce milk at 50 to 75 per cent. less cost than the others. Every penny of reduced cost means that much increased profit. Yet it is hard to get these unsuccessful ones to study. In these times of low prices they are groaning with financial colic, yet no man can get them to see where the waste is."

"*What is the food cost of a pound of butter?*"

An answer to this question is very difficult from the fact that so much depends upon factors which are not stated; if all the materials used as feed are purchased, the question should have one answer; if these products are all produced upon the farm the answer will be different, because the production of the butter saves the marketing of the raw material and being on the farm saves the cost of bringing the purchased food to the farm.

At a recent meeting of the Creameries' Association of Ontario, Canada, an address was delivered, a portion of which answers this question as follows:

"There are several important factors which enter into this question—the man, the cow and the feed. The food-cost of a pound of butter depends upon the man who is doing the feeding, upon the cow to which the food is given, upon the kind of food, whether suited to milk production or not; upon the milker—a poor milker may easily increase the food cost of the butter; upon the man who handles the milk; an ignorant, unskillful person wastes or spills a portion of the butter given by the cow, adds to the food cost of that which is saved or well made, and, finally, upon the man who markets the finished product. It will be noticed in the foregoing that the 'man' enters into this problem five times, the 'cow' once and the 'food' once. Therefore, five times as much care should be given to the 'man' as either of the other two factors."

One of the professors of the Agricultural College at Guelph, Canada, answers the question by theory experience at the college, where the feed, milk and other products were all weighed during the year 1896, and the milk of each cow carefully tested. From the report of this experiment, we condense the following:

The highest yield of butter per cow was 424 pounds, and the lowest 120 pounds; the average yield per cow was 244 pounds. The highest food cost per pound was 22.2 cents and the lowest 8.8 cents, the aver-

age being 13.9 cents per pound. The cow's butter which cost 22.2 cents per pound lost her feeder $2.69, while the one making the butter at a food cost of 8.8 cents per pound made her feeder a profit of $47.30 —the butter in both cases selling for 22 cents per pound.

Of the two following tables, the first shows the food cost of the butter only, while the second shows the food cost of the milk per gallon, the butter per pound and the cheese per pound:

Month.	Number Cows Milking.	Food Cost of 1 lb. Butter.
		c.
December, 1895,	16	18.8
January, 1896,	16	14.0
February, 1896,	15	12.3
March, 1896,	17	13.6
April, 1896,	18	10.4
May, 1896,	17	6.7
June, 1896,	21	4.2
July, 1896,	22	8.3
August, 1896,	24	12.6
September, 1896,	21	17.3
October, 1896,	22	15.3
November, 1896,	20	12.5
Average for year,	19	12.1

Month.	Number Cows Milking.	The Food Cost of		
		1 Gal. Milk.	1 lb. Butter.	1 lb. Cheese.
		c.	c.	c.
December, 1895,	16	8.00	18.8	8.4
January, 1896,	16	6.20	14.0	6.1
February, 1896,	15	5.75	12.3	5.5
March, 1896,	17	6.30	13.6	6.1
April, 1896,	18	4.60	10.4	4.6
May, 1896,	17	2.80	6.7	3.0
June, 1896,	21	2.00	4.2	1.8
July, 1896,	22	3.70	8.3	3.7
August, 1896,	24	5.09	12.6	5.6
September, 1896,	21	7.74	17.3	7.7
October, 1896,	22	7.20	15.3	6.8
November, 1896,	20	5.90	12.5	5.6

The low cost of the products in the months of May, June and July is explained by the fact that the pasture was charged at $1.00 per month per cow, and that the cows had more than the pasture, a portion of the time no meal at all being fed.

" *What is 'filled cheese?'* "

Filled cheese is made from milk from which more or less of the cream has been removed and some other fatty material substituted; the usual substitute for the cream is "neutral lard," or material prepared somewhat in the same way as oleomargarine for butter; this, in a melted form, is added and the cheese made up in the usual manner. The proportions used vary greatly, but usually, if used at all, the substitutes are used to a large extent and the cheese practically becomes an oleo cheese.

Under the National law, a government tax of one cent per pound is levied upon all "filled cheese" manufactured, and all manufacturers and retailers must take out a special United States license, which varies in accordance with the amount made.

The United States law took effect September 6, 1896, and from that date until the end of the fiscal year, June 30, 1897, there were, according to United States Government records, 1,663,067 pounds made, which paid a tax of $16,630.00 into the United States Treasury.

Seven factories paid a government tax of $400.00 per annum, and one wholesale establishment, in Maryland, paid a tax of $250.00.

Sixty-two retail establishments were reported and paid a special United States tax of $12.00 each, or a total of $744.00; of these, four were in Illinois, three in Indiana, twenty-nine in Louisiana, nineteen in Maryland, two in Missouri, two in New Jersey, two in Virginia and one in West Virginia. No "filled cheese" was withdrawn for exportation during the period above mentioned.

The laws of Pennsylvania forbid the manufacture or sale of "filled cheese" under heavy penalties, and the Department of Agriculture had, for a considerable time, watchmen looking after a large lot in cold storage in Pittsburgh. It was claimed that the lot was in storage in transit to West Virginia, and this eventually proved to be the case, or at least it was taken out of the State.

Prof. Wiley thus describes the manufacture of "filled" cheese:

"An emulsion of lard is made by bringing together in a disintegrator lard and skimmed milk, both previously heated to 140 Fahr., in steam jacketed tanks; the disintegrator consists of the cylinder revolving within a cylindrical shell; the surface of the cylinder is covered with fine serrated projections, each one of which is a tooth with a sharp point; as this cylinder revolves rapidly within its shell the mixture of melted lard and hot skimmed milk is forced up in the narrow inter-

space and the lard become very finely divided and most intimately mixed or emulsioned with the milk. This emulsion consists of from one to three parts of milk to one of lard; it can be made at one factory and taken to another to be used for cheese, but it is usually run at once into the cheese vat.

"In making the cheese a quantity of this emulsion, containing about 80 pounds of lard, is added to 6,000 of skimmed milk, and about 600 pounds of butter milk in the cheese vat and the lard that does not remain incorporated with the milk or curd (usually about 10 pounds), is carefully skimmed off. These quantities of materials yield about 500 to 600 pounds of cheese containing about 70 pounds of lard or about 14 per cent. About one-half of the fat removed in the skimming is replaced by lard."

"*What is the cause of what is known as ropy milk?*"

A number of years ago the experience and observations of the writer led him to enumerate the following as among the peculiarities of this trouble, and also possibly some of its causes, and he has had no reason to change them since:

That the trouble is often not apparent when the milk is first drawn from the cow.

That, after standing a short time, the ropiness commences to develop and increases rapidly in extent and viscidity.

That in many cases it is scarcely to be detected in the milk, but is shown to an unusual extent in the cream.

That some cows are predisposed to it to a much greater extent than others.

That it is more likely to show itself during hot weather following an unusually dry time.

That it is more prevalent during that portion of the season when the difference of temperature between day and night is most marked, or when we have a succession of hot days followed by cool nights.

That it is most prevalent when the animals are not provided with the proper shade or other shelter from the hot sun.

That it is most commonly absent or least prevalent during cool and moist summers and autumns.

That animals having plenty of running water, shade and regular supply of salt are rarely affected.

That the theory that small doses of saltpetre administered every other day will cure or prevent the evil, has no foundation in fact.

That all of the surroundings of the disease lead to the conclusion that, whether caused by fungoid growth or not, it is in fact a species of partial decomposition.

That it is due to a disease in the system of the animal, and that, to be effective, all cures must begin there, and that external remedies, while they may possibly mitigate the trouble, are not to be depended upon.

That a careful examination of each cow's milk will usually show that the whole mixed milking is infected by the milk of a single cow, and that the evil is not as widespread as some are inclined to suppose. That the fact that, without any changes in the local surroundings, it will disappear as rapidly as it came, warrants the conclusion that it is due to some temporary disarrangement of some of the animal secretions.

That cows which have access to both upland (artificial) and meadow pastures are least likely to be affected by the trouble.

That it is quite probable that the fungoid growth which is found in the milk may be the result of the partial decomposition, and not its cause.

"*What is the cost of a good Osage orange hedge?*"

So much depends upon the manner of planting and treatment that it is difficult to give a satisfactory answer to the question. A number of years ago the Secretary of the State Board of Agriculture issued a number of circulars to farmers who were known to have planted more or less hedge, and their answers were so varied that it was very difficult to tabulate anything like a satisfactory result. The estimate for the number of plants per one hundred rods varied from 2,500 to 4,000, and thick and thin planting each had their respective advocates.

Our own experience would indicate five inches as the proper distance apart for the plants, thus making the number for each hundred rods about 3,500.

Taking the answers which furnished the described data, and discarding all that were evidently defective, the average result was about as follows:

3,500 plants at 50 cents per hundred, ...	$17 50
Preparing ground for the hedge, ...	8 50
Setting plants already trimmed at the nursery,	4 75
Trimming and cleaning during first year, ...	2 50
Trimming and cleaning during second year, ...	4 00
Trimming and cleaning during third year, ...	4 50
Trimming and cleaning during fourth year, ...	5 00
Total cost of hedge at 4 years old, ...	$46 75

Many plans of planting were advocated, and their estimated cost varied, for one hundred rods of hedge, from three to five dollars. A few even exceeded the latter figure, but were all for planting on sod, which materially increased the expense. The writer, in all of his planting, always so arranged it that the line of the intended hedge should be one of the rows of a corn field and, hence, at planting time, there was no sod and the ground was in excellent condition for the growth of the young hedge plants. After a careful double plowing, a furrow was drawn along the line of the proposed hedge so that the straight land side was exactly where the plants were wanted; they were carefully placed against the land side of the furrow, their lower ends resting on the bottom of a rather deep furrow, and the finer portions of the soil drawn in with hoes and tightly tramped down around the plants, of which not more than one per cent. were lost and needed resetting the next autumn.

"*What is the primary cause of the disease known as anthrax?*"

It may be caused by quite a number of causes, but first of all they must have the germ which gives it its peculiarities; this being absent, we are to assume that the disease will not exist.

In referring to the causes which induce the rapid increase in the germs which characterize the disease, Prof. James Law writes as follows:

"It is propagated by contagion but tends to die out when produced in this way alone. It is transmitted by contact with the blood, liquid exudations, portions of the diseased carcasses, fat, skins, hair, wool, bristles, feathers and bowel excretions and rarely or not at all through the atmosphere. Simple contact of these matters with the healthy skin of a susceptible subject is enough to produce the disease. The virus is most potent when received from an animal still living, and only recently dead, and yet may be preserved for months in all conditions of climate, temperature and humidity."

The same authority states that the development of the disease is determined

"1. By the rich surface soil abounding in organic matter and the impervious subsoil preventing natural drainage.

"2. The frequent inundation of the banks of rivers flowing through a level country, and the drying up of ponds and lakes, leaving much organic deposit in their basins.

"3. A continuation of warm, dry weather, which favors organic emanation from such places as the above.

"4. A condition of the system of the animal predisposing to the reception and growth of the poison, and consisting in loading the blood with plastic or waste organic matter, as in overfed plethoric animals,

in those taking flesh most rapidly, in the young and growing, in those rendered unhealthy by overwork, impure air, unsuitable food or water.

"5. Sudden chills when the poison is already prevalent; hence, extreme variations in temperature of night and day.

"6. A close, still atmosphere."

The outbreaks which have come under the care of the Department have, in many cases, been caused more or less directly by long spells of dry weather which had dried up the ponds at which the stock usually obtained water or which had so reduced the volume that the remaining water reaches a high temperature during the warm portion of the day.

In most of the cases the outbreak has given way on the removal of the animals to high and drier pastures, with pure water and less succulent grasses.

"*Which is the most profitable source of phosphoric acid, ground bone or South Carolina Rock?*"

If both are acidulated or treated with acid, the only difference in value will be the probable difference in market price. South Carolina Rock furnishes the most economical source of available phosphoric acid known, it having been sold to farmers this year at prices which made the available phosphoric acid cost but little more than three and one-third cents per pound.

Usually, when the two sources are compared, the dissolved rock is compared with the ground raw bone; in this case it must be remembered that the phosphoric acid in the bone is in the form or combination known as "insoluble," while that of the South Carolina Rock is in the form known as "available," and, hence, the two cannot be fairly compared. The phosphoric acid in the rock is at once available as plant food, while that of the ground bone becomes available much more slowly; the one has had its combination with lime so changed that it has become soluble either in water or in or by the solvents usually met with in the soil; the other has its combination unchanged and cannot rapidly become available plant food until the change is effected through the medium of soil solvents.

The total or general effect of the two will probably not vary greatly, except that the bone will require a much longer time to make its action visible.

In estimating the value of ground bone and in comparing it with other fertilizing materials, it should be remembered that in addition to its phosphoric acid, it also furnishes more or less nitrogen to the crop, and that it should be entitled to a credit for this element; thus, if a ton of ground bone cost twenty dollars and yields four per cent. of

ammonia, the amount of eight and one-half dollars should be deducted from the price of the bone in order to obtain the actual cost of the phosphoric acid remaining. If, in such case, the nitrogen was not needed, then ground bone has not proven an economical source of phosphoric acid or of plant food, for an amount equal to eight and one-half dollars per ton has practically been thrown away.

"*What is the comparative value of the different forms of nitrogen made use of by manufacturers of fertilizers?*"

The comparative value of nitrogen from the different combinations which usually enter into commercial fertilizers depend so much upon the soil and crop that the question becomes a very difficult one to answer. The question can probably best be answered by the following table condensed from Wagner, which, taking the action of Chili saltpetre as 100, ranges the other sources after it, in the following order and relative value:

Nitrogen in Chili saltpetre, ...	100
Nitrogen in sulphate of ammonia, ...	90
Nitrogen in blood and green plants, ...	70
Nitrogen in fine bone, ground fish, etc., ...	60
Nitrogen in stable manure, ...	45
Nitrogen in fine, ground wool, ...	30
Nitrogen in fine ground leather scraps,........	20

Dr. Lindsay, in reviewing the results of German experiments with nitrogen, draws the following conclusions:

"The grains in the following order, viz: barley, wheat, rye and oats have the greatest need of soluble nitrogen, such as nitrate of soda and sulphate of ammonia, because of their short growing period, while roots, late potatoes and grasses, having a longer growing period, can use the slower, lasting forms of nitrogen, such as stable manure, tankage, bone, etc., to better advantage.

"In order that the plant may use costly nitrogen to advantage, it must be well supplied with potash and phosphoric acid.

"Warm, porous soils, rich in lime, favor the most rapid nitrification of ammonia compounds. When the soil is lacking in lime, sulphate of ammonia works poorly as a soil fertilizer. Its action can be greatly improved by liming the soil. The lime neutralizes the sulphuric acid, set free by the process of nitrification, and thus prevents an acid soil. It is well known that bacteria, as a rule, will not work when free acid is present."

"*In his address this morning, Secretary Edge alluded to the dangerous character of glanders; what are its symptoms?*"

Circumstances and surroundings somewhat modify the symptoms of this disease; symptoms which might be correct for low and illy ventilated stables would not be recognized in cases in which the animal is more or less exercised in the open air; symptoms which might be correct for a poorly fed and neglected animal might not be recognized in one well cared for and fed.

Dr. Williams thus describes the symptoms of the disease:

"The disease, preceded by increased temperature of the body, appears suddenly, ushered in by rigors, sometimes of the most persistent character. In one case which fell under my notice the rigors continued without intermission for three days and nights, at the end of which time a sanguineous discharge issued from both nostrils, the Schneiderian membrane became violently inflamed and deeply ulcerated. More commonly, however, the rigors are not so persistent, but they are always more or less observable; the temperature is sometimes as high as 106 and even 109 degrees; the breathing is accelerated, the pulse feeble, rapid and even dicrotonous; the heart's action palpitating and accompanied by a metallic tinkling; the appetite fails, the pituitary membrane, at first of a dark copper color, with patches of ecchymosis of a dark red hue, becomes purple and patches are rapidly converted into pit-like ragged edged ulcers from which issues copious sanious discharges. The eyes are weak and discharge issues from them; the nostrils are often swollen. The breathing is hurried, irregular and impeded by the swelling of the nostrils and by glutinous discharges drying around them; abscesses speedily form along the course of the lymphatics of the face; the urine is pale and increased in quantity."

"*Are potato diggers a success?*"

So much depends upon circumstances that the question may be answered either in the affirmative or negative; they do pay if everything is in proper condition for their use; if the soil is just dry enough and not too dry, if it is free from stones, if the potatoes are not too deep—in fact if all the surroundings are favorable. Mr. Terry, well known to those who attend Pennsylvania farmers' institutes, a few years ago wrote as follows:

"It seems to me that, with over 500 diggers patented, we have not yet, so far as I know, a perfect one; I have tried one of the best, the price of which was $125. The manufacturer was here in person, and every possible effort was made to make it work, but it has gone back. I know it does work satisfactorily under some conditions, for parties using it have written me so. On level prairie or other light soil, with

potatoes hilled, I should think it would do fair work. With us, it left too many tubers covered up. We dug the ground over with a fork and found some eight or ten bushels per acre. This, at the lowest price we ever sold the crop for, would pay for hand digging. But we shall soon have a perfect digger; it will only be a matter of time; meanwhile, if we keep our fields clean, it will not cost much to dig by hand. It cost me just one cent a bushel to dig my crop by hand in 1883. This may be hard for some to believe, but it is a fact. One man dug all but a few. He had worked for me some five years, and was an expert in that line. One week he dug 180 to 190 bushels per day for six days. His best day's work, in nine hours (he had to stop before night to cover the piles), taking the potatoes right through the field, just as they came, was 223 bushels."

"*What is the difference between the various forms of potash as found in the market?*"

Potash is not found in a free state naturally, but is always in combination with some other element; when in combination with chlorine, we have the chloride or muriate of potash; when in combination with sulphuric acid we have the sulphate of potash, well known to the trade, and which exists in large amounts in different portions of Europe; and if in combination with nitric acid, we have the nitrate of potash. All of these forms are valuable in fertilizers, but some of them appear to have better effects with certain crops than others, but, for the average crop, their selection is largely a question of the price per pound of the potash which may be obtained from them.

Under some circumstances the most economical form of potash is that from kainit, or German potash salts. It is, however, possible, where freight and handling are competing integers in fixing the cost, that some of the higher brands of commercial salts of potash may be found most economical for use.

The difference in their action is often caused by the fact that, independent of the direct action as plant food, they exercise more or less effect upon other soil elements of plant food. Thus, they are supposed to more or less act upon and liberate latent phosphate compounds in the soil, and, hence, if applied to one soil rich in these compounds and to another poor in them, different effects will be noted. Another cause, if a difference in effect, is that they may be and sometimes undoubtedly are applied to soil which already contains a sufficient amount of potash in an available form for the wants of the crop; in such cases their effect would of course be negative and possibly very different from that which follows the application to other soils not rich in potash compounds.

The fact is that all potash salts, and practically all fertilizing articles, have two modes of action; if both of these are exercised it is but reasonable to suppose that the effect will be greater than if but one mode of action is brought into play; if the application acts as a direct fertilizer by furnishing the crop with needed potash and, in addition, releases phosphoric acid for plant food, the effect is double that produced upon an adjacent soil already rich in potash, and on which the effect is that of action upon other compounds alone.

"*Where fertilizers are applied in large amounts, is it not possible that a portion of the plant food is lost by being washed out of the soil?*"

The loss from this source would greatly depend upon the condition of the special plant food under test; if it was nitrogen, the loss would greatly depend upon its form; if it was applied as a nitrate, which is one of the most soluble forms, and large amounts were used, no doubt a considerable portion would be lost before a long season crop, like wheat, would utilize it; if, on the other hand, it was in the form of dried blood or some of the most insoluble forms, less would be lost, and if in the form of ground leather scrap, probably little, if any, would be lost.

The loss of fertility is greatest with nitrogenous materials, and least with those containing phosphoric acid. Loss of phosphoric acid is prevented by the fact that the "soluble," which is readily dissolved in water, does not exist in the soil except for a very short period of time, too short in fact to admit of loss until the form has been changed. The "soluble" soon takes up another portion of lime and takes on the "reverted" form, in which it is not nearly so soluble, being only taken up through the medium of other chemical constituents in the soil by the plant roots.

If phosphoric acid is applied in the "insoluble" form, the loss is very slight, indeed, and the material will probably remain in the soil until slowly appropriated by the roots of the plants. Crude ground South Carolina or Florida Rock may remain in the soil for years without producing any appreciable effect, and when an effect is produced, the probability is that it is due, not to the use of the material as direct plant food, but to its influence and effect upon other plant food already in the soil.

In the form of ground bone there is but a slight loss of either the nitrogen or phosphoric acid, as both are in a sparingly soluble form, and, consequently, this fertilizer may be more safely applied in large amounts.

"*One of the speakers this morning stated that peach trees but slightly affected by the yellows would ripen their fruit earlier for a year or two before the disease was noticeable in the leaves or branches; how may this fruit be distinguished?*"

Dr. Smith writes: "These prematurely ripened peaches differ from healthy ones very materially in color. Once seen, they can never be mistaken. Generally, they have more color than healthy peaches, but essentially the difference lies less in the amount of color than in the peculiarity of its distribution. Instead of being delicately punctured with minute crimson dots, or imbued with uniform masses of color like the ruddy cheek of a healthy peach, the surface is closely blotched with red and purple spots of variable diameter, but usually not less than one-sixteenth of an inch across. These give the peach a mottled or speckled appearance, unlike that produced by any other disease, and so entirely different from the healthy appearance that the yellows might, in many cases, be diagnosed from a very small fragment of the skin of a single peach. Sometimes these spots are infrequent, sometimes they are very numerous. Usually they are somewhat sharply defined on a much lighter background, but sometimes they coalesce, giving the whole peach a dark crimson or purple color, or, more rarely, a brown purple or dull red."

"*What are the provisions of the inter-state commerce law to which one of the speakers alluded this morning?*"

Inter-state commerce law controls and governs the passage of articles of commerce between states or through states; it prevents, within certain limits at least, the interference on the part of any one state with articles en route to another state. Thus, for instance, the inter-state commerce law would protect cheese en route from New York into Pennsylvania until it reached its first sale in our State; at this point, the State laws take effect, and the cheese becomes liable to the police regulations of our State. Until it is offered for sale in our State, the State officers cannot enforce the laws of the State, and the article is under the protection of the National Government.

Diseases of live stock furnish us with another instance of the provisions of the inter-state commerce law. Animals in transit from one State to another, if diseased, are under the control of the National Government, and State officers can not interfere with them; when they are unloaded and offered for sale, they lose their identity as articles of commerce en route to another state, and become amenable to the laws of the state in which they are sold or offered for sale.

In the enforcement of the act to regulate the manufacture and sale of cheese, the provisions of this law are shown by the fact that the Department of Agriculture cannot enforce the provisions of the

cheese law until the goods reach an ownership in the State; they may be brought into the State and remain in storage indefinitely without being subject to our State laws, but as soon as they become a portion of the general property of the State, they become amenable to the law alluded to.

"*Mrs. Rorer, in effect, states that of all the trades the farmers' family uses the worst balanced ration upon their tables; is this correct?*"

Possibly when considered theoretically, it is; but then rations for individuals, like those for cattle, may be all right theoretically and all wrong practically. Mrs. Rorer, or any other good authority, might fix up a ration for me which would be all right theoretically, but after all I might prefer to be a little less scientific and eat what I wanted, even at the risk of not having a properly balanced ration.

We, like our live stock, have digestive organs very differently constituted; one can digest pork and cabbage and grow fat upon it, and, add science to the contrary notwithstanding, work well and live long upon it; my neighbor possibly has a differently constituted stomach and cannot digest this kind of food; it is to him, no matter what science may say, an unbalanced ration, and he will neither grow fat nor work well upon it. It is, however, true that there is more danger from poorly balanced rations of food than from those properly balanced, but this danger and possible injury is dependent more upon the individual than upon the food, and no rule can be laid down for the government of either.

There is not the least doubt, however, that the rations used upon the table of the average farmer might be improved upon, and if the good wife had the choice that falls to the lot of her city sister, would at once be improved upon, but during the winter months the farmer's wife, especially if away from the city and line of travel, has but little choice of the food which goes upon her table. The pork and flour barrel must necessarily, whether right or scientific, furnish the bulk of the farmer's food, and until this is remedied, there will not be much gain in the line of improved rations for farmers.

"*Cannot the condition of our roads be improved by changes in our road laws?*"

This admits of two answers—yes and no. If the writer is to judge of our people by the debates in the Legislature, and sometimes in farmers' institutes, he would be perfectly safe in coming to a conclusion that good roads may be made by legislation, but in practice we find that this is by no means the case. Until our people are educated up to it, the chances are that changes in our road laws will produce but

little practical effect. So long as we are careless in the selection of our road supervisors, and, after electing them, allow them to do exactly as they please, we need not look for much improvement under any law that can be enacted.

The great difficulty with road legislation in our State is that no general law can be drafted to suit all sections; the law which would give good results in Chester and Montgomery counties would be of but little practical value in Carbon and Cameron. It would therefore, seem as if we would have to get along with a kind of a skeleton act which would be expansive enough to suit all sections and yet preserve the outward form of a State law.

But the misfortune is that legislation will not make good roads; if it would, then we should, with our four hundred or more local laws, have about the best roads in the nation. Money and men are both necessary for good road building, and unless we have both and get them together, we will not obtain good results. In many cases we undoubtedly have both and they fail because we do not get them together. Some townships vote considerable sums of money and have poor roads, while others collect a lower road tax and have better roads; the first may have the money and the second the men; if both were joined, better results would have been attained.

The new law has not yet gone into effect, and we are, therefore, working under the same law as one year ago. Examination will clearly prove that either law is capable of giving us good roads, but that neither will do it without good management and funds; under the present law, the supervisors can macadamize the roads of their townships, but to do this they must be backed up by funds and the co-operation of the people who are interested and who pay the taxes. With this co-operation, the average supervisor can, under the present law, give his constitutents good roads, but they must expect to pay for them.

"*Is there any special benefit derived from feeding green or immature rye or corn?*"

The benefit, if any, has been greatly overestimated and the possible medical benefit confounded with that affecting food values only.

Until a stalk of rye comes out in head or a stalk of corn in tassel, it contains little or no real food value, but after it has passed this point its character changes and from that onward takes up increasing amounts of plant food and becomes correspondingly more valuable as stock food.

After either have passed a certain point, all of their food value is above ground and the saving of it becomes merely a question of cost;

thus, when corn is ready for the silo, it may be taken in and thus preserved; if it had remained out longer and been husked, no food value would have increased but the food which was in the stalk in the ensilage would have simply passed upward and forward into the ear, and considered as one, the stalk and ear would have contained the same food value as they did when cut for the silo.

The contest between the two plans (the silo and husking), therefore, resolves itself into the one of cost of the preservation, and in this respect, within certain limits, the indications are that the silo has the advantage.

We have fed green corn to cows and, after eating large amounts, have had them bawl, apparently for something else to eat. The indications were that, in its excessively green state, it did not contain sufficient food value to enable them to get enough into their digestive organs to satisfy hunger, but after the tassel or smaller ears had formed this was all changed, and the effect was visible not only in the animals themselves, but also in the milk pail.

Until the plant begins to take steps towards the formation and perfection of its seed, much of its subsequent food value has not left the ground, and if the crop is fed in this state it is lost to the stock and their owners. But after it has passed this point and has begun to store up plant food for the formation of its seed, its character changes and it furnishes more and more food value as it approaches maturity.

"*Have potato growers gained anything by the decrease of the legal weight of a bushel of potatoes from sixty to fifty-six pounds?*"

Practically, nothing at all; any purchaser, knowing that he is to get fifty-six pounds fixes the price accordingly; any other course is not reasonable or business like. The fact is that it is time that our farmers should realize that State standards are only of use in settling disputes between seller and buyer, in the case of sales in which nothing definite has been fixed. If I purchase potatoes of my neighbor and fix no standard in the bargain, I, of course, cannot compel him to give me more than fifty-six pounds to each bushel, but I might, without any violation of law, have fixed the standard in the bargain at one hundred pounds; the only difference would have been that I would have been compelled to pay proportionately a higher price per bushel.

In California there are practically no standards and farm commodities are quoted by the cental or the one hundred pounds, and purchasers buy fractions of cental by weight. This plan avoids all disputes as to measures, and would take away from the sweet potato vendor the value of fixing the potatoes in the half or quarter of a peck. If he sells by weight, he has no interest or gain in placing them in the measure and his occupation, at least in this respect, would be gone.

It is stated that after dealers get used to it, weighing involves no more trouble than measuring, and is much more satisfactory to both parties interested, and it certainly does away with all bickerings as to state and other standards of weight.

"*Is there any violation of law where a club of farmers purchase fertilizer supplies, and employ one of their number to mix them for the club?*"

The Department of Agriculture has never, in any manner, opposed such modes of obtaining feritlizers, nor has the Attorney General ever given the Secretary an opinion upon the point involved in this question. It is quite possible that the legal answer might turn upon the question as to whether the agent thus employed was paid anything for the work of mixing the fertilizer. It is not at all likely that this question will ever seriously arise, but the attention of the Department has been called to it by the manufacturers, and they have made the claim that within the meaning of our law, the agent who does the mixing is, for the time being, a manufacturer of fertilizers, and, therefore, subject to the provisions of our fertilizer act.

If this agent who is employed to do the mixing receives a consideration for his work, it may be claimed that he is in precisely the condition that he would have been had he charged a fixed price per ton, or that he would have been had he purchased the materials according to order and delivered the mixed goods to those who wanted them.

The violation of the fertilizer law is not in the manufacture, but it is in the sale or offer to sell, and if this agent makes neither a sale nor an offer to sell, it is difficult to see how the law can possibly be construed so as to in any manner affect him or his transactions.

It is, however, very easy to see how and where this distinction may be lost and he be brought under the provisions of the act alluded to. It is claimed by some that if he makes a fixed charge per ton, either for the purchase of the materials or for the mixing, he becomes de facto a manufacturer and as such is liable under the law. There is, however, no desire upon the part of the Department to in any manner interfere with farmers who wish to mix their own fertilizers according to their own formulas, but it has several times directed the attention of such to the possible difference which exists between a mixture and a compound.

"*Does the law of our State make it obligatory upon the farmer to brand or mark the cheese which he may sell to his local storekeeper, or which he may take there in exchange for goods purchased?*"

The law makes no exception, whatever, but requires that all cheese sold or offered for sale within the State shall have the name and ad-

dress, with the quality, placed upon the top and bottom of the boxes and on two sides of the cheese in letters one inch high. The only exception to this is in the case of cheese less than one foot in diameter, where there is not room for the name and address in such large letters. In such cases, the Department of Agriculture has ruled that the name and address may be in letters not less than one-half inch long, but that the words denoting the quality of the cheese as, for instance, "full cream," must be in one-inch letters.

Primarily, the law is for the protection of the consumer; it is not intended to prohibit the use of skim-milk cheese, but its object is to enable those who want a full cream cheese to obtain it readily. Any one, whether a farmer or more extensive manufacturer, may skim his milk as closely as he wishes, but having done so he cannot be allowed to sell the cheese as a full cream cheese, but must brand it so that its true character and value may be known; and the retailer who sells, or offers for sale, a cheese which is not properly marked or which is below its stamp in actual fat contents, is equally liable, and the manufacturer, if he resides with the State, will be punished with the retailer.

If, therefore, a farmer or dairyman sells cheese to any one, either a neighbor or his local storekeeper, he should, if he wishes to avoid possible trouble, be careful to strictly comply with the law in marking the boxes (if any are used) and the cheese; a failure to comply may subject him to a heavy penalty which is shared by the local dealer who offers the cheese for sale, either whole or cut.

"*Can any one so inclined purchase oleomargarine and bring it into the State for his own use?*"

Certainly he can. The inter-state commerce law will protect such a purchase until it reaches the one who ordered it, and so long as he does not offer it for sale in any manner, it is still under the protection of the same law.

The police and other regulations of our State can only affect sales of goods already in the State, but they cannot interfere with the passage of such commodities from dealers or manufacturers outside the State, either to residents of the State or to parties beyond the State. Thus, our cheese law affects all cheese made in the State, but it can have no effect upon New York cheese until it is offered for sale in Pennsylvania; the inter-state commerce act protects the cheese from the borders of our State until it reaches the consignee in this State and protects it there so long as he does not offer it for sale.

Returning to oleomargarine as an illustration, the law recognizes the right of the citizen to use this article, and to purchase it at any point outside the State, or within it either, for his own use; but he

cannot use it on a boarding-house or hotel table or at any place at which food in which it is used is furnished or for sale, the courts having decided that if sold with or in articles of food, it constituted a sale interdicted by the laws of the State.

A citizen of our State may purchase the article in our State. The offense against the law is then committed by the seller, and not by the buyer. The latter only comes in contact with the law when he offers it for sale in any manner.

"*What causes the difference in fertilizing value in the different brands of South Carolina Rock?*"

The value of the Dissolved South Carolina Rock depends upon the amount of its phosphoric acid which has been made available as plant food. The phosphoric acid in the original rock is in a form or combination in which it is very slowly available as plant food. The manufacturer adds sulphuric acid, breaks up the old combination, and forms others which are much more readily available.

In the fertilizer trade we find four grades or combinations of phosphoric acid, all of which have a different value. Three of these are found in our South Carolina Rock fertilizers, and its value for plant food depends upon the comparative amounts of the different forms, it being most available as the more soluble form predominates.

If the manufacturer adds sulphuric acid to the crude rock, the old form of four parts of lime to one of phosphoric acid is broken up and two others formed, one of which (soluble) is composed of one of lime and one of phosphoric acid, and the other two of lime and one of the acid. The third is in its unchanged form, not having been acted upon by the sulphuric acid, and is composed of three of lime and one of phosphoric acid.

In the different materials which furnish us with phosphoric acid we find a great difference in their ability to furnish it in a condition fit for plant food. Ground bone and crude South Carolina rock both have the phosphoric acid tied up with three parts of lime, but in the former, the combination is much more readily broken up and made available as plant food, and as a natural consequence, the efforts to make use of the crude ground rock as a fertilizer have not yet been profitable, it being more profitable at present prices to purchase some of the more reliable forms.

In reality, we have four forms of phosphoric now on the market, viz:

Soluble, one part of lime to one of acid; reverted, two parts of lime to one of phosphoric acid; insoluble, three parts of lime and one of

acid, and a fourth (slag phosphate) which has four of lime to one of phosphoric acid. All yield phosphoric acid to the crop in different degrees of rapidity, and are valuable in proportion to the readiness with which they yield available plant food.

"*Has the practice of cooking feed for the stock proven profitable?*"

Not as a rule; in many, and in fact most cases, it has been abandoned after a brief trial, or as one of my neighbors put it a few years ago, "it it only profitable where there are ample funds to back it and where those who practice it do not have to pay either interest or rent."

The cooking makes a certain proportion of the food available which would have otherwise gone to the manure pile, and to the stock farmer who studies economy, it is merely a question of dollars and cents. If the amount of food thus utilized or saved is worth more than the cost of the operation, it has paid; otherwise it is unprofitable unless there is some other source of profit as, for instance, the benefit derived from warm food as compared with cold or uncooked.

The action of cooking is to break up the starch cells of the food so that their contents can be utilized by the digestive organs of the animal. The question, then, to decide is whether it is cheaper to break up these starch cells by the action of heat, trust to the action of the gastric juices secreted by the organs of the animal, or buy the starch in the form of other or more food; the stock breeder has his choice, and there can be no room for doubt that much money has been wasted in cooking stock food, not because it did not enable the animal to get more available food from a given amount, but because this gain was obtained at too great a cost.

The same argument is true as to grinding grain. The eastern feeder criticises his western brother because he feeds his corn in the ear without grinding, and yet that brother knows by experience that the grain which he can possibly save by grinding will not pay him for the cost of taking it to the mill and the miller's toll or charges, and that it is cheaper for him to make use of more grain to reach a certain result than to attempt to save it by grinding.

It is also no doubt correct that there are stock feeders in our own State who, owing to distance from the mills and other causes, are paying too dearly for the amount of food which they save by having the grain ground for stock.

"*Are there not more rapid means for making cider vinegar than the common one of fermentation employed by the farmer?*"

The same result may be obtained by much more rapid processes, but they are only profitable where large amounts are to be converted into vinegar. In his bulletin on the "Cider Vinegars of Pennsylvania," Dr. Frear thus gives two of these processes:

"In what is known as the 'Orleans process,' the barrel is partly filled with a mixture of old vinegar and cider; as soon as the acetification of the cider is complete, the speed of the oxidization being caused by the presence of the old vinegar, one-half of the mixture is drawn off and a fresh portion of cider is again added, and the process renewed.

"The Dutch process is a much quicker one. Vats are filled with thick shavings, whose surfaces are overgrown with vinegar ferment, receive trickling streams of warm cider from a tank above. These are met by a rapid current of air rising through ventilators about the bottom of the vat. The liquid dripping from the shavings is completely acetified. This process is employed in most large vinegar-making establishments. Whenever a high temperature or a rapid current of air is used to hasten the process, it is always at the expense of part of the alcohol which is volatilized. The loss is often very considerable, sometimes fully one-third. Some loss attends every process, so that, although the theoretical yield is scarcely five parts of acid for four parts of alcohol, or eight parts of sugar, the actual results obtained in practice fall much below these figures."

"*What connection is there between the ticks and the Texan fever?*"

That there is some connection between the ticks sometimes found on cattle affected with Texan or southern cattle fever and the fever itself, is undoubted; but just where and how this connection is to be made is by no means so clear. The United States Department of Agriculture, under the special direction of Dr. Salmon, has been conducting experiments for several years, and in one of their recent reports thus state their conclusions:

"The hypothesis which seemed most plausible after the experiment of 1889 was that the tick, while withdrawing blood from the southern cattle drew out in it the Texan fever parasite, which, entering into some more resistent state, perhaps some spore state, was disseminated over the pastures when the body of the mother tick became disintegrated. These spores were then supposed to enter the alimentary tract with the food and infect the body from this direction. The latter experiments completely demolished this conception. Neither the feeding of adult ticks and tick eggs nor the feeding of grass from infected pastures gave any positive results. On the other hand, the unmistakable outcome of the experiments was that the young tick introduced the infection into the body. This fact implies two possibilities. Either the tick is a necessary or a merely accidental bearer of the micro-parasite. If a necessary bearer of the infection, we must assume that the latter undergoes certain migrations and perhaps certain changes of state in the body of the adult tick, and finally becomes

lodged in the ovum. Subsequently, it may become localized in certain glands of the young tick and discharge thence into the blood of cattle. This hypothesis assumes a complex symbiosis between the tick and the parasite on the one hand, and the cattle and the tick on the other. According to another simpler hypothesis, the tick would be merely an accidental bearer of the infection. The parasite entering the body of the tick with the blood of the cattle may be already in the spore state or about to enter upon such a state. The young ticks, as they are hatched near the body of the female, may become infected from this. This infection, clinging to their mouth parts, is introduced into the blood of the cattle to which they subsequently attach themselves. Further investigations are necessary before the probable truth of one or the other of these hypotheses can be predicated with any degree of certainty."

"*Have there been any legal decisions confirming the provisions of the division fence law of 1842?*"

The case of Odenwelder vs. Frankenfield (in 153d Pennsylvania Reports, page 526) seems to fully confirm the provisions of this act, but it has been claimed that this decision was more or less complicated by the fact that the fence causing the dispute was not only a line fence, but also one along a public lane.

In the Chester county courts, before Judge Hemphill, the provisions of the act were fully confirmed in the case of Roberts vs. Sarchet, who were owners of adjoining farms. The fence was bounded on both sides by "improved" lands; it consisted of 245 panels, of which the plaintiff maintained 126 panels and the defendant 119; the tenant of the plaintiff's farm requested the defendant to repair his portion of the fence and he refused. In accordance with the provisions of the act of 1842, which makes the auditors of the township the fence viewers, two auditors met and examined the fence, the tenant being the third auditor, could not serve. After a careful examination, the viewers found that the plaintiff maintained a good and lawful fence, but that of the defendant's portion of the fence 58 panels needed resetting and 61 panels needed more or less repairing. They also directed the defendant to repair the fence within ten days, as is required by the act. After fifteen days had passed and the defendant had not repaired the fence, the tenant of the plaintiff proceeded to make the necessary repairs at a cost of $26.68, which the defendant refused to pay. Suit was brought as above and resulted in the defendant being ordered to pay the amount with costs within thirty days.

The defence of the defendant was that the viewers had neglected to set forth in their verdict the sum which was necessary for the required repairs, and that inasmuch as the first section of the act of 1700

had been repealed, it carried with it the definition of what constituted a fence in the State and, hence, that there was no power lodged anywhere to determine what the fence should be; both of these objections were overruled by Judge Hemphill, and the case argued and decided upon its merits, based upon the act of 1842.

"*What is the yield of butter per cow in a first class dairy, and what is the cost of the milk?*"

We can probably give no better answer to this question than to quote the following from our own writing in the annual report of the State Board of Agriculture for 1893. The extract is from that portion of the report relating to an extended experiment with cows at the Cornell Experiment Station, under the care of Prof. Wing, and is as follows:

"It will be noted that the production of each cow is stated in 'butter fat' pounds and not in butter, as ready for the market. Assuming that average butter contains 20 per cent. of water, salt and other matter not butter fat, we may conclude that the average yield of the herd was equal to 357 pounds per cow, but it is not safe to assume that, in the ordinary dairy practice, we can obtain all of the butter fat from the milk; but assuming that one-half of one per cent. of the butter fat will be lost in the milk and butter milk, we have 332 pounds left as the annual average product per year of each cow. From the table it appears that the best cow gave 439 pounds of butter fat which, upon the same basis as is used in the calculations above, is equal to nearly 550 pounds of marketable butter.

"It will also be noted from the table that while, on an average, the largest yield of milk produced the largest yield of butter, yet the cow which gave the largest weight of milk (11,165 pounds) did not make the largest weight of butter fat, which is credited to a cow producing but 10,754 pounds of milk.

"In this connection it may be interesting to note that the average live weight of the cows is 1,138 pounds and their average product of milk is 7,240.5 pounds or at the rate of a trifle more than six and one-third times the weight of the average cow.

"From this table the following are, by calculation, obtained: Average cost of food was $45.25; the highest cost per cow was $53.38, and the lowest was $36.24; the average cost of the milk was 62.5 cents; the highest cost per 100 pounds being $1.48 and the lowest 44 cents. Putting the value of the milk at $1.00 per 100 pounds at the barn, we find that all of the cows but two were producing it at a profit and, valuing the butter at 25 cents per pound (or the butter fat at 30 cents), all the cows were more than earning their keep in the butter product alone."

AGRICULTURAL LEGISLATION OF 1897.

By the Secretary.

The legislative session of 1897 was unusually prolific in acts relating, directly or indirectly, to agricultural interests, and if among these we include the laws relating to game, the session of 1897 probably left the largest collection of this class of legislation upon our statute books of any within the past fifteen or twenty years.

The indications, however, are, judging from results, that the representatives of the legal fraternity in the Legislature permitted their agricultural brethren to draft, prepare and carry through the agricultural legislation of the session in their own way. Whether this is correct or not, the agricultural legislation of the session, among which we include all acts referred to the Department of Agriculture for enforcement, is marked by acts which are too cumbersome and which impose too many inconveniences, and in some cases too much expense, upon other classes without any corresponding gain to the producer and consumer whose interests were to be protected; of this class the acts relating to cheese and vinegar may be taken as types, the former providing for five grades of cheese, where two would have amply protected the interests of the consumer and inflicted less inconvenience upon the producers and dealer. The act relating to vinegar, while it supplies some of the omissions in the act of the previous session, is made too long and cumbersome for easy enforcement, and inflicts unnecessary inconveniences upon the producer. Both of these acts also contain the very doubtful provision of seizure and spoliation.

The following may be accepted as the leading and most important acts, at least indirectly connected with agricultural interests, because they were referred to the Department of Agriculture for enforcement, which have been added to our pamphlet laws.

"An act providing for the regulation of the manufacture and sale of distilled and fermented vinegars; prescribing their standard; to prevent the adulteration of the same; providing for the enforcement thereof and punishment for the violation of the same."

During the work of the Department in enforcing the act regulating to the manufacture and sale of cider vinegar, it was found that a great

amount of fraud was rendered possible because distilled and other cheap and low grade vinegars could, by coloring, be sold for cider vinegar. It was, therefore, thought that the manufacture and sale of all distilled and fermented vinegars should be brought under the provisions of a general act. The act alluded to is, however, unnecessarily lengthy and verbose, thus leaving ample room for legal quibbles on the part of lawyers of such defendants as are prosecuted, and it will be a benefit if the act can be shortened and made more plain and positive in its provisions.

The act very properly lowers the standard of cider vinegar from two per cent. of solids to one and one-half per cent., and regulates the branding of packages of all kinds of vinegar so that, if its regulations are carried out, the purchaser may know what he is buying, or at least it places him in a position to avoid the fraudulent sale of substitutes for cider vinegar which, in reality, cost their manufacturers but a few cents per gallon.

The act provides that all fines and penalties recovered shall be paid into the State Treasury for the purpose of its enforcement, and gives the unusual power of seizure and spoliation to the State officers whose duty it is to enforce the act.

The act positively forbids the use of coloring matter of any kind, but permits the use of spices which do not color the product. It also provides that all fermented vinegars, including cider vinegar, shall contain one and one-half per cent. of solids and four per cent. of acetic acid.

"An act to prohibit the adulteration or coloring of milk or cream by the addition of so-called preservatives or coloring matter, and to provide for the enforcement of the same."

This act was passed during the session of 1895 but was rendered inoperative by the misplacement of a comma, and this year is again rendered worthless and inoperative by improper punctuation and the addition of one letter not contained in the law as it was originally offered to the Legislature.

The act was intended to prevent the shipment of milk and cream during warm weather periods of scarcity, from New York state to Philadelphia and other large milk and cream markets. By the addition of certain substances, named in the act, known as "preservatives," the milk may be and is shipped long distances, and, with the exception of the changes caused by the added materials, arrives in comparatively good condition even in hot weather.

The first section of the act contains the following language and punctuation:

"That the sale, or offering for sale, of milk or cream for human consumption in this Commonwealth, to which has been added boracic acid salt, boracic acid, salicylic acid, salicylate of soda or any other

injurious compound or substance for artificially coloring, the same shall be a misdemeanor."

The addition of the letter "f" before the words "or artificially coloring the same," renders the act of doubtful meaning, because these materials are not added for artificially coloring mi'k or cream but for the purpose of preserving it so that it may be carried longer distances.

The act, as presented to the Legislature read as follows:

"That the sale, or offering for sale, of milk or cream for human consumption in this Commonwealth, to which has been added boracic acid salt, boracic acid, salicylic acid, salicylate of soda or any other injurious compound or substance, or artificially coloring the same, shall be a misdemeanor."

If, however, it is at any time shown that milk to which preservatives have been added is injurious to health, the Secretary of Agriculture has ample power to stop the process under the provisions of the pure food law, and the Department has already delegated one of its chemists to make an examination and report as to the effects of these substances upon the human system. The Secretary is also empowered, by the same act, to prohibit the use of coloring matter if it is known to be injurious to the health of those who used the material thus colored, and it is believed that he has full power, under the pure food law, to prevent the coloring of any article of food.

"An act to provide for the investigation of the diseases of domestic animals and making an appropriation therefor."

During the work of the State Live Stock Sanitary Board, its members have all been strongly impressed with the view that much of the loss now sustained by the live stock owners of the State is of a class which might, by the adoption of proper precautions, be prevented. It appears to the members of the Board that if these diseases, or any large proportion of them, can be prevented, that funds expended to prove and show this fact would be a better investment than if used in paying for animals condemned and killed after they are diseased. Hence, the State Veterinarian asked for the passage of this act, and it is the intention of the Board to institute careful tests and experiments to learn, if possible, just what may be accomplished in the line of prevention.

As an instance of this, it is the experience of members of the Board that tuberculosis may be greatly influenced in the extent of its outbreak and the character of the cases, by surroundings and treatment; they have, therefore, instituted a series of experiments, under the provisions of this act, in order to ascertain what may be accomplished in the line of prevention, by exercising better care as to ventilation, feeding and the usual surroundings of animals already infected or liable to infection, but these experiments have not yet sufficiently progressed to warrant even a preliminary report.

From careful observations, the Board is, however, convinced that

proper ventilation and sunlight have much to do with the destruction of disease germs and that, at least in many cases, the outbreaks of tuberculosis might have been reduced to a minimum of loss had the rules of ventilation and admission of air been more closely followed.

"An act to prevent fraud and deception in the manufacture and sale of cheese, defining what shall constitute the various grades of cheese, providing rules and regulations for the marking and branding of the same, providing for the enforcement of this act, prescribing penalties for its violation."

The intent of this act is to raise the grade of the cheese manufactured and sold in the State, and to prevent the sale of low grade and skim-milk cheese for full cream, but it has been made unnecessarily difficult and burdensome to both manufacturers and dealers. The division of cheese into five grades makes the act difficult to enforce and places the manufacturer under restrictions and inconvenience which do not produce corresponding benefits to the consumers or purchasers.

The laws of New York and Ohio recognize but two grades of cheese, and that which does not come up to the requirements of a "full cream" cheese, or show thirty-two per cent. of butter fat, is classed as a "skim-milk cheese," and the purchaser, like those who purchase and use low grade and adulterated food products, must protect themselves against the amount of skimming which may have been practiced.

The next Legislature should be promptly asked to reduce the number of grades of cheese from five to but two, and to so modify the regulations as to branding or stamping as to cause less inconvenience to manufacturers and dealers. This can be readily accomplished, and at the same time secure equal protection to the consumer.

An extensive series of analyses, embracing nearly 400 samples, selected in various portions of the State, clearly prove that the standard of "full cream" cheese, as established by this law, is liberal towards the manufacturer, and shows that some have reached a standard of over 42 per cent. of butter fat. These analyses also prove that the cheese sold in our State are not of nearly so low a grade as was represented during the session of the Legislature when this act was under consideration.

This act, like the one to regulate the manufacture and sale of vinegar, contains the doubtful provisions of forfeiture and spoliation, and needs several other changes and amendments which have been made apparent during its enforcement by the Department of Agriculture.

"An act to prevent the spread of the contagious disease known as yellows, black knot, peach rosette and pear blight among peach, plum, cherry, prune, almond, apricot, nectarine and pear trees, or the fruit thereof, and providing measures for the eradication of the same, and applying the provisions of this act to the San Jose scale when found on any vine, plant, shrub or fruit tree."

The act makes it the duty of township supervisors, board of road

control or borough or city council, when information has been made to them of the existence of any of the diseases named in the act, to appoint three freeholders of the district represented by the appointing power, whose duty it is, after information has been made, to notify any person upon whose ground or property the disease may exist, to take measures to destroy it within ten days, and if the owner neglects or refuses to take this action, the board are empowered to act themselves and charge the expenses to the township, or borough or city, as the case may be. The party or owner thus neglecting or refusing is subject to a penalty of not more than one hundred dollars.

The commissioners thus appointed are given ample and unusual powers for the destruction of diseased trees, or, in the case of black knot, with the destruction of "parts of trees," and are allowed two dollars for each full day and one dollar for each half day employed in the duties of their offices, and in cases in which the parties interested have refused to take the proper steps to abate the nuisance, the cost incurred by the commissioners may be collected from those so refusing or neglecting to comply with the orders of the board. The law gives unusual powers to the commissioners, but has not yet been, so far as reported, tested, and hence no definite opinion can be given of its operations, but it is generally believed that it will remain a dead letter upon our statute books.

"An act to regulate the standard weight of a bushel of oats."

The act fixes the standard weight of a bushel of oats at thirty-two pounds, and is too high for an average crop of ten or fifteen years. Previous to the date of the act the standard had been established at thirty pounds. During the war the United States Government was a large purchaser and demanded thirty-two pounds as a bushel; the State standard being then but thirty pounds, more or less confusion arose.

It, however, matters but little to either buyer or seller what the standard may be, as it in no way influences prices and only serves as a deciding factor when no agreement was made when the purchase was made. The somewhat popular theory that any decrease in the standard weight of any grain is a gain to the producer is an error, as it is evident that the less the purchaser receives, the lower the price.

It would very much simplify such transactions if such commodities were quoted, bought and sold by the cental, or one hundred pounds. All disturbing elements in relation to varying state standards would be removed and all quotations, no matter in what state they were made, would be readily understood without any calculations or examination of state laws, and the trouble in effecting sales and deliveries would be greatly lessened.

"An act authorizing the purchase by the Commonwealth of unseated lands for the non-payment of taxes, for the purpose of creating State forestry reservations."

This act provides that before any unseated lands are sold for the taxes, the Secretary of Agriculture and the Commissioner of Forestry are to be notified by the county commissioners, and if, in the discretion of these officers, the lands to be sold are suitable for forestry reservations, they may purchase them for the Commonwealth.

All lands acquired under this act are to be under the management and control of the Secretary of Agriculture and Commissioner of Forestry, and in this respect this act is in conflict with the general act for the acquirement of forestry reservations, which places them under the care and control of a commission named in the act. If this plan of acquiring forestry reservations is to become effective, its provisions should be made to conform to those of the general forest reservation act so that there may be no division of authority.

"An act to secure State forestry reservations and providing for the expenses thereof."

This act provides for a commission composed of the Commissioner of Forestry, the Chairman of the State Board of Health, the Deputy Secretary of Internal Affairs, and two persons, one of whom shall be a lawyer or conveyancer of at least ten years professional experience, and the other a practical surveyor, to be appointed by the Governor, who shall have power to locate forestry reservations as follows:

1. One of not less than 40,000 acres upon the waters which drain mainly into the Delaware river.
2. One of not less than 40,000 acres upon waters which drain mainly into the Susquehanna river.
3. One of not less than 40,000 acres upon the waters which drain mainly into the Ohio river.

The commissioners named are given the right of eminent domain, and all lands thus taken are to be paid for in the usual manner from the State Treasury.

The object of the reservations is to obtain control of the forests near the head waters of our main streams, and to retain them for the purpose of regulating the passage of rainfall into the rivers. The forests invariably hold the water back and prevent its passage into the rivers and streams too rapidly, the leaves and masses of decayed vegetable matter acting like a sponge in holding the surplus water, and giving it off to the springs gradually. The general public is benefitted by the reduction in the height and damage of floods, and by an extension of the rafting season over a greater length of time.

This act received my hearty endorsement last year, and when carried into force, will place Pennsylvania in line with New York in protecting her water courses from floods and drought.

Inasmuch as the commissioners serve without extra compensation, the funds appropriated are all applicable to the objects of the act.

"An act to provide for keeping the public highways from becoming blocked with snow."

The act provides that the supervisors of public roads may remove any rail or board fence which they believe causes the retention of snow upon the public highway and to substitute a wire fence. The act provides that the cost of the wire fence shall not exceed, so far as the township is concerned, the first cost of the wire, which the act specifies shall not be barbed. Stone walls and ornamental fences are exempted from the provisions of the act.

The probable effect of this act, if put into force, will be to create local disturbances, but there is no doubt but that there are many points at which the substitution of wire for rails or boards will do much to prevent snow from drifting in the public roads.

The provisions of the act will hardly be extended to such sections or townships as sell the mending of their roads at public sale, as, in such cases, it is the duty of the purchaser to keep the roads free from snow and in all respects passable for travel.

One of the probable effects of the act will be to create a desire, on the part of the owner of the fence, for the substitution of wire for old and worn out fences which may possibly cause the collection of snow to an even greater extent than new ones.

"An act for the destruction of wild cats, foxes and minks in this Commonwealth, and providing for the payment of bounties on the same, officers' fees and fixing the penalty for violations of the same."

This act provides for a bounty of two dollars for each wild cat, one dollar for each red or gray fox and fifty cents for each mink killed.

Unlike many preceding acts of a like character, this provides proper guards against frauds on the part of persons killing or claiming to have killed such animals, and will, to this extent at least, protect the county treasuries.

"An act to protect the health of the domestic animals of the Commonwealth of Pennsylvania."

The State Live Stock Sanitary Board is empowered to take all proper measures to eradicate dangerous contagious diseases which may break out among the live stock of the State; they have actively engaged in the work since the creation of the Board, and have taken a strong and decisive action against outbreaks of tuberculosis, glanders, etc., when reported to them or when discovered by their agents; many diseased animals have been condemned, killed and paid for.

In the progress of the work it was found that there was no protection against infection from surrounding states, and it became evident that the objects sought by establishing the Board could not be attained as long as infected animals from other states were allowed free ingress and, hence, the legislation under consideration.

The act provides that the State Live Stock Sanitary Board may establish inspections at points at which dairy stock enter the State, and may give the owners of stock being transported their choice of the following alternatives:

1. An inspection may be made at the points at which the stock enter the State or at which they are unloaded for feeding and water, and certificates be granted which, if they are found to be free from disease, will carry the animals to their destination in the State.

2. Certificates issued by other states which have proper laws and officers may be accepted in lieu of examination by officers appointed by this State, and used to protect the passage of the animals to their destination in this State.

3. The stock may be sent, in quarantine, to their destination in this State and there be examined and certificates sent to the Live Stock Sanitary Board.

The act did not go into effect until January 1, 1898, and there has not been a sufficient time to test either its working powers or its efficiency, but it is believed that by this course, which is without direct cost to the State, the passage of infected animals into our State can be prevented, and the cost of eradicating contagious diseases of animals be correspondingly reduced.

It is expected that by co-operation with the National Department of Agriculture and the use of officers already stationed at proper points, the cost to the owners of live stock can be materially reduced without in any manner injuring the efficiency of the work.

"An act providing for the election and appointment of road supervisors in the several townships of this Commonwealth, defining their duties, authorizing them to make, repair and maintain roads and bridges, let contracts for the same, levy and collect taxes, employ labor, divide townships into districts, appoint road masters and treasurers, purchase road-making implements and machines, prescribing penalties for violation of this act, and requiring road supervisors to report to township auditors and to the Secretary of Agriculture from time to time, and for the repeal of all laws, general, local and special, inconsistent herewith or supplied hereby."

This act is the result of much thought and deliberation on the part of Prof. John Hamilton (Deputy Secretary of Agriculture), and makes some radical and important changes in the methods of selecting supervisors and of mending highways.

The first section regulates the election of the supervisors so that but one goes out of office each year, and thus ensures the continuance of any line of policy which may have been adopted by the board, and does away with that continual change of policy which has heretofore proved so disastrous to improvement in this line.

The second section fixes sundry regulations in the routine duty of the supervisors, but follows the provisions of the old law insomuch as it limits the assessment of road taxes to ten mills for regular and ten for special purposes.

The fourth section permits the levy of from one-fourth to one-half of the road tax in cash, and this section takes from the supervisors the duty of personally superintending the work of repairing roads, and empowers them to appoint a road master, who shall have charge of all repairs, and the employment of men and the arrangement of the manner of working out that part of the road tax which may be paid in work.

The act provides for regular reports to certain officers, and, though necessarily somewhat long, covers the main points in road repair and road construction. In some of its sections it demands radical changes in the present methods of mending roads.

One of the strongest points in the new law is the provision by which the election of supervisors is robbed of many of its present objections. Under the present law the action of the supervisor is too often controlled by a desire for re-election, and his position in relation to work upon the public roads is too often affected by this desire for favorable action at the expiration of his term of office. The new law places the question of the length of a day's work and the character of that work largely in the hands of an officer who, while he is appointed by the supervisors, is not dependent upon the public, who work out their road taxes, for his appointment, and, in theory at least, we may expect that he will be more free from bias than the supervisors under the present system.

The twenty-second section contains the provision that "all acts, or parts of acts, general, special or local, inconsistent herewith or supplied hereby, be and the same are hereby repealed." A number, whose opinions are usually considered reliable, take the position that a general act can only be repealed by a specific repealing act, and that a local or special law can only be repealed by a strict following of the demands of the Constitution as to advertisements, etc. If this view is correct, it will, more or less, interfere with the effect of the new law, as we have over four hundred special and local acts, and, until these are taken from the statute book, the action of the new law will be more or less limited by them.

The twenty-first section contains a clause which prevents the act from going into effect until the Legislature makes an appropriation of one million dollars for "making and maintaining public roads."

Opinions to the effect of this proviso differ greatly. A number believe that it will effectually tie the act for a number of years as, with a capitol building to erect, with decreased revenues, etc., it is not likely that such an appropriation will be made. Upon the other hand, it is claimed that the coming Legislature must do something to relieve the agricultural population of our State from a portion of their present burden of taxation, and that such an appropriation, by reducing the road tax, will effect this result.

DIVISION OF FARMERS' INSTITUTES.

THE ORGANIZATION OF INSTITUTES.

By PROF. JOHN HAMILTON, *Deputy Secretary and Director of Institutes.*

SUGGESTIONS TO LOCAL INSTITUTE MANAGERS.

The leading purpose of the farmers' institute is to improve agriculture, by carrying information in regard to this occupation to those who need it, and by developing individual self reliance, intelligence and prosperity among country people, to fit them in the highest degree for the performance of their duties as citizens in the State, and for the production in the most economical and profitable manner, of the crops, animals and products needed by civilized mankind.

HOW BEST TO DO THIS.

It can not be done by confining our efforts to the process of pouring truth, however valuable, into people. They must be brought to help themselves, and this is best done by starting them to working out some of the problems of agriculture, and writing down the results of their research and experience, and presenting their conclusions for the criticism of practical and scientific people, thus stimulating honest inquiry and crystalizing thought into available, practical and useful forms. Develop, therefore, local people. Outside lecturers and teachers are valuable for the assistance and encouragement which they give to local talent, but ought not in any case to occupy more than a fair proportion of the time at the disposal of the institute. Keep in mind the fact that the main object of the institute is to develop home talent.

HOW TO GET READY FOR AN INSTITUTE.

Begin at least two months before the time set for the meeting. Select a proper locality. Avoid large towns. Appoint a live local committee of men and women to take charge of all the local ar-

rangements, such as securing the hall, advertising the institute, sending out invitations to editors, school teachers, farmers and others, and securing good music for every session. When the date for the institute arrives, this committee should see that the hall is comfortably heated, lighted and ventilated; meet and welcome visitors, and preserve order during the sessions; see that the State speakers are met at the station, and shown the way to comfortable lodgings.

Appoint a committee of energetic men and women to take charge of the question box. Have them prepare questions and send them a couple of weeks in advance to local people qualified to answer them, and notify these people that they will be called upon for a three or five minutes' talk in reply.

Advertise by posters, bills and programmes. Notify all the public schools in the vicinity; also all the farmers' clubs, granges, alliances and county organizations. Select your local speakers several weeks before the date of the institute; good, bright men and women to prepare papers. Audiences will no longer endure stupid speeches. Choose people who have good character in the community. Advise short papers and to the point. Prepare your programmes and have them printed six weeks before your institute. Secure a good blackboard, and provide crayons and erasers for the use of lecturers.

How To Prepare a Programme.

For a two days institute, provide five sessions, beginning in the afternoon of the first day. Put no one on the programme who has not definitely promised to be present, and who has not declared his willingness to take the part assigned. The address of welcome should be short. Fix a time for taking up each topic. Provide for the discussion of every subject. Adopt the five-minute rule in all discussions. Print the name of the presiding officer for each session, and see that a live, energetic and competent man is selected. A poor chairman will destroy the life of your meeting. Avoid sectarian and partisan topics. Provide some good music for the evening session. Do not have too many subjects for discussion, but confine a session as nearly as possible to some leading topic, and have it thoroughly considered. See that proper questions are provided beforehand, and that there are persons present that can answer them in a satisfactory way. A sample programme for a two days' institute is given on pages 243-246. Print on your programmes the names of your county board of institute managers, the local committee of arrangements, and the committee on queries. Do not neglect placing on your programme the names of several ladies.

How to Conduct an Institute Successfully.

If an institute fails, it needs a new manager. All depends upon the manager. Begin on time, and speak out so that all can hear you

easily. Adopt the five-minute rule and enforce it. Cut off cranks and prosy speakers promptly. Appoint a competent secretary to take notes. Never take up a collection. Provide in some other way for extra expenses. See that programmes are distributed through the audience. Give the reporters every facility for taking notes of the proceedings. Shut off discussions when the time is up. Rule out all sectarian and partisan discussions. Preserve order. Encourage timid speakers by a hearty word and a pleasant introduction. See that the local speakers have a fair chance to be heard, and that they are not crowded out by visiting lecturers. Do not permit the committee on resolutions to introduce any resolution on subjects not discussed in the meeting, but confine them strictly to the work of the institute. Do not permit questions to be propounded and answered which relate to subjects on the programme, until the speaker regularly scheduled has been heard. If time hangs heavy, fall back on your committee on queries. Make frequent use of this committee, and encourage all to ask questions.

The Question Box.

Your institute cannot fail in interest, if you have a live and competent committee on queries. No disappointment on account of speakers not appearing, or other failures in your programme can seriously affect your institute, if the members of the query committee have done their duty. The members of this committee should take notes of speeches as they are delivered, and have questions ready to propound as soon as opportunity is given. If there are several persons on the committee, they should be distributed throughout the audience, so that the questions will come from various parts of the hall, thus having the appearance of spontaneity, which will add materially to the interest. As already stated, this committee should be appointed a considerable time in advance of the meeting, and they should work up an interest by sending out queries to specialists in their neighborhood, with a request to have them replied to in three to five minute speeches. They should avoid frivolous and irrelevant questions. Suppress personal and unseemly questions. The chairman of the query committee should have charge of the question box, and read the questions clearly, with voice enough to be heard all over the hall. Try to have the questions of an agricultural character, and such as will suggest valuable truth.

How Many Sessions of Institute to Hold.

As a rule, the five session institute is the best. This gives time for both local speakers and visiting lecturers to be heard, and also allows a greater variety of subjects to be treated than is possible in a single day. Begin with the afternoon of the first day. Also hold

a session in the evening, and have three sessions the second day. By delaying the opening until the afternoon of the first day, more time is given for lecturers to go from one institute to another, and you are nearly certain of being able to start with a full house.

Where to Hold an Institute.

Locate where there is a good hall. As a rule avoid large towns. Go to the country and the smaller villages. These institutes are in the interest of farmers, and should be held where the farmers live. Arrange the places so as to be accessible, and where comfortable accommodation can be had for visitors. Go as a rule where successful institutes have been held before, and do not select all new places each year.

State Speakers.

All of the expenses, including compensation, railroad fares and hotel bills of State speakers will be borne by this Department. At points where there are no railway communications, the people of the locality in which the institute is held are expected to transport the speakers from one institute to another in the country, and to and from the railroad free of charge. The State speakers have been chosen because they are experts and specialists. They are not expected to know everything, but are supposed to be thoroughly posted in regard to all matters relating to their specialties. Questions, therefore, should be directed to them which bear upon their particular lines of preparation and experience, and all who have questions of this sort should be encouraged to ask for information.

Advertising.

You may plan an institute, engage the finest and most capable speakers, arrange the most interesting and instructive programme of exercises, but if it is not thoroughly advertised, you will have empty benches. Have prepared large and attractive posters; at least one hundred (100) for each institute. Send them all around and see that they are properly posted in favorable localities. Send programmes to the school teachers to be distributed to the scholars. Get the publishers of your county papers to give you a notice, and prepare it for the editor as an attractive local. Send special postal card invitations to friends and agriculturalists all over the county. Make the institute known and get it talked about, and people will come.

Do not try to do all the work yourself. Get others to help you and they will become interested, and the labor be lightened. After

the date is advertised, do not change it, but go ahead and hold the institute.

Do not neglect any organization or class of people, because of your personal prejudice or dislike. Invite all and give them a cordial welcome when they come. Invite the school children. Invite the ladies. Invite the editors. Invite everybody.

SPECIAL INSTRUCTIONS.

In order that the work may be most effective, our efforts should be concentrated upon a few fundamental objects, rather than be scattered over a large area, thus wasting power and accomplishing comparatively little. Much institute work in this and other states has failed to effect the best results, not because the workers were not competent, conscientious and energetic, but because those directing their efforts did not have before them, a well defined and definite set of objects to be attained. It is proposed to attempt to correct this error into which we and others have fallen, by prescribing three topics which are to be discussed in every institute to be held in Pennsylvania this season.

In every two days' institute, the evening session of the first day is to be set apart for the benefit of the ladies, and is to be in the interest of "Country Homes." This will include all that relates to home life in the country. The constructing of homes, the heating, lighting, ventilating and sanitary arrangements for country homes; the water supply, sewage and plumbing for houses in the country; the cooking of foods, the care of the sick, the care of children, flower gardening, kitchen gardening, house decoration and all that relates, in any way, to comfort, convenience, health and enjoyment in a country home. As many ladies as possible should be put on the programme for this session.

The afternoon session of the second day is to be devoted to the subject of "Good Roads." This is a "Supervisor's Session," and as far as may be necessary, all discussions are to be upon the subject of roads and their improvement. The evening session of the second day is to be an "Educational Session," and is to be distinctively in the interest of the education of the farmer and his children, and all that concerns their intellectual nature and development. Under this topic can be discussed the course of reading for farmers, the institute, the grange, the alliance and the farmers' clubs as educators. Also the country district school, the country high school, courses

of study for country children, etc. To this all school teachers and school children ought to be invited; also school directors, county superintendents and all who are interested in the education of country people. In the two other sessions, institute managers have the option of introducing such topics relating to agriculture as they deem best, but the three sessions, named are prescribed, and no option is given with regard to them. This is done that we may, in all of our institutes, concentrate all of our energies, for at least one season, upon the solution of these most important questions that now interest us as farmers, and affect so deeply the present and future well being and prosperity of ourselves and our children. Another season we can take up some other topics and discuss them thoroughly, and thus get at the best thought of our farmers upon matters vital to agricultural people. Every two day programme, therefore, will contain these three topics, and have them scheduled at the time of day just designated.

Every one day institute will have the afternoon session devoted to "Good Roads," and the evening session to "Education for Farmers and their Children." The morning session is left open for the more general topics relating to agriculture. Let us all unite in a determined effort to make these discussions of the greatest value to the interests represented, and thus come to a more perfect understanding, as to what is best to be done, in regard to these serious social questions which confront us. In selecting speakers, therefore, keep in mind the topics prescribed, and secure persons who will be able to give information that will aid us all to a better understanding of the subjects discussed, and form the basis for making up a judgment upon which to act.

Programmes.

All programmes are to be printed and ready for distribution at least one month before the date of the institute, and at least one dozen copies are to be sent to the Director of Institutes for filing and for sending to the lecturers in the field. This is necessary in order that all interested may be fully informed.

Presiding Officer.

Three sets of State lecturers will be in the field. One member of each set will be the special representative of the Department, and shall have charge of the section. During the sessions of institute he shall sit with the presiding officer and assist him in the performance of his duties. If the presiding officer is absent, he shall preside in his stead until he returns. These gentlemen are chosen for their superior qualities as institute workers, and are men of large experience. The purpose of associating them with the presiding officer is to make sure

that no institute shall suffer from incompetence in its chairman or from his indiscretion.

Each State lecturer is required to make out a separate report for each institute held and send it to the Director of Institutes, giving the number in attendance and interest manifested, the character of the speeches and papers, together with such other suggestions as he may have to make with regard to the meeting. He will in every case accompany this report with a copy of the programme of the institute.

The chairman of the county board of institute managers is also to make a report upon the blank forwarded to him for the purpose, and mail it to the Director of Institutes as soon as possible after the close of the sessions of meetings held in the county. They will also collect the essays read, and send them to the Director of Institutes as soon as practicable.

Advice to Speakers, State and Local.

Be sure that you are heard and understood in all parts of the hall. Speak out and speak distinctly. No man or woman is fit to be an institute lecturer who cannot be heard and understood, no matter how wise or learned he or she may be. If you have something valuable to say and know that you have a voice too weak to be heard, write out your speech and get some clear voiced man or woman to read it for you. Do not use long introductions. Come to the point and stick to it. Quit when you are done. Do not talk to kill time; usually there is none to waste. Do not pretend to know something that you do not understand. Be courteous to those who differ with you, and be patient as possible with people who talk absurdities.

DIRECTIONS FOR CONSTITUTING LOCAL COMMITTEES ON INSTITUTE WORK IN THE SEVERAL COUNTIES OF PENNSYLVANIA.

The act of March 13, 1895 (section 5), makes the following provisions: "That it shall be the duty of the Director of Institutes to arrange them in such manner as to time and places of holding the same, as to secure the greatest economy and efficiency of service, and to this end he shall, in each county where such institutes are to be held, confer and advise with the local member of the State Board of

Agriculture, together with the representatives duly appointed by each county agricultural, horticultural or other like organization, with reference to the appointment of speakers and other local arrangements."

In order to carry this provision of the law into effect, the Director of Institutes directs that these representatives, one from each county organization as stated, duly chosen and properly accredited, together with the local member of the State Board of Agriculture, shall constitute a board of county institute managers, of which the local member of the State Board of Agriculture shall be the chairman. The organizations entitled to representation, are, county agricultural societies, county horticultural societies, pomona granges and county alliances.

The duty of this board shall be to confer and advise with each other and the Director of Institutes, with reference to the appointment of speakers and other local arrangements for holding institutes.

It shall be the duty of each county organization named, to notify the Director of Institutes of the appointment of its representatives, and at the same time give a similar notice to the local member of the State Board of Agriculture, if there is one in that county.

The local member of the State Board of Agriculture, together with these representatives of the county organizations, shall meet for organization on the second Tuesday in June in each year, at one o'clock p. m., in the county town, at the office of the county commissioners. At this meeting the places for holding institutes for the ensuing season shall be selected, the same to be subject to the approval of the Director of Institutes. An institute committee will also be appointed, at this time, for each locality in which institutes are to be held.

The local member of the State Board, and each duly accredited representative of the county organizations in attendance upon this meeting, shall upon the certificate of the chairman of the board of managers, be paid his expenses, not to exceed two dollars.

In these meetings every member shall have equal voice, and the action of the majority shall decide. Notice of the action of the board shall be sent by the chairman to the Director of Institutes, within ten days after the meeting.

In counties where the State Board of Agriculture has no member, or when he may for any reason decline to serve as member and chairman of the committee, the representatives of the county organizations mentioned, shall elect a chairman and notify the Director of Institutes of the fact. Or, if after the meeting for organization the chairman does not call a second meeting of the committee at least sixty days prior to the date fixed for holding the first institute, then

the other members shall meet and proceed to arrange for the institute, first notifying the Director of Institutes of their action.

In case no representative from any county organizations of that county shall appear in the meeting on the second Tuesday of June as stated, then the local member of the State Board of Agriculture shall immediately report the fact to the Director of Institutes and proceed to arrange for the holding of institutes that year, without further consultation with the local organizations.

All moneys alloted to any county, for use in institute work, will be paid to the chairman of the local committee, to be accounted for by him in an itemized statement, audited and signed by auditors appointed by the committee, and then forwarded to this Department, not later than the first day of May in each year.

APPORTIONMENT FOR SEASON OF 1896-7.

In order that the boards of institute managers may have full information in regard to the plans of the Department, as to the institute work for the coming season, the following distribution of time for holding institutes is presented.

The apportionment shows the number of days that the Department will furnish two lecturers to each county, for institute work during the season of 1896-7. It is made on the basis of two days of institute, to every county having not over 1,000 farms; three days to each county having more than 1,000 and not over 1,500; afterwards, one day for each 1,500 farms or fraction thereof additional. This insures Department aid to each county, in proportion to its agricultural interests. The State has been divided into three sections, with one hundred days to each section, except the first, which is ninety-nine. A separate set of lecturers will be assigned to each section, and in a given county, the same Department workers will continue until all of the institutes in that county have been held.

The amount of money to be distributed to the various managers for local expenses, will be according to the number of days of institutes held. Heretofore, a sum would be expended by a manager upon a single institute, which in the hands of another manager would be sufficient for four or five. This was manifestly unfair to the citizens of the county whose manager happened to be extravagant or

careless. To equalize the expenditure, the distribution hereafter will be according to the number of days of institute held.

In order to arrive at a proper sum for each day's expenses, the Director has investigated the practice of many of the states, and has also taken the average of expenses for the past year in our own State. The average cost for local expenses for the past year in this State, taking the institutes as held under the new method, was $6.54 per day. In order to make the amount ample for the coming season, the sum has been increased to $9.00 per day of institute. This provides $18.00 for each two days of institute, to be used for local expenses, and there will be in addition, the State help of two lecturers, which with the local assistance, ought to carry the work through in a creditable manner.

Past experience in most of the counties, has shown that the two day institute is much more economical and efficient than the one-day meeting. In the one day meeting the time is usually given to the visiting lecturers, to the exclusion of local aid, on the ground that the people wish to hear the strangers, and as there is not time to hear all, the visitors are given the preference. This is a serious mistake. The main object of the institute is the development of the local people, and whatever interferes with this, ought to be corrected. A two-day institute gives ample time for all to be heard, and provides, also, for the deliberate and full discussion of matters of interest that may arise. The morning session of the first day is almost always a failure, and ought to be dropped, and the institute begin at one p. m.. and continue for five sessions. This gives time for the visiting lecturers to reach the ground, and begins the work with the advantage of a full house.

Where there are odd numbers of days in the allotment to a county, of course, one single day institute is unavoidable. In that case it will be well to begin in the morning, and hold three sessions, running the risk of a small attendance at the beginning.

APPORTIONMENT FOR 1896-7.

	Days.		Days.		Days.
Adams, ...	5	Allegheny, ...	6	Bradford, ...	7
Berks, ...	7	Armstrong, ...	5	Cameron, ...	2
Bucks, ...	7	Beaver, ...	4	Carbon, ...	2
Chester, ...	7	Bedford, ...	5	Clarion, ...	5
Cumberland, ...	4	Blair, ...	4	Clearfield, ...	4
Dauphin, ...	4	Butler, ...	6	Clinton, ...	3
Delaware, ...	3	Cambria, ...	4	Crawford, ...	8
Franklin, ...	5	Centre, ...	4	Elk, ...	2
Fulton,...........	3	Columbia, ...	4	Erie, ...	6
Lancaster, ...	9	Fayette, ...	5	Forest, ...	2
Lebanon, ...	4	Greene, ...	4	Jefferson, ...	4
Lehigh, ...	5	Huntingdon, ...	4	Lackawanna, ...	4
Montgomery, ...	6	Indiana, ...	6	Luzerne, ...	4
Northampton, ...	5	Juniata, ...	4	McKean, ...	3
Northumberland, .	4	Lawrence, ...	4	Monroe, ...	4
Perry, ...	4	Lycoming, ...	5	Pike, ...	2
Philadelphia, ...	2	Mercer, ...	6	Potter, ...	4
Snyder, ...	4	Mifflin, ...	3	Schuylkill, ...	4
Union, ...	3	Montour, ...	2	Sullivan, ...	2
York, ...	8	Somerset, ...	5	Susquehanna, ...	6
	——	Washington, ...	5	Tioga, ...	5
	99	Westmoreland, ...	5	Venango, ...	4
			——	Warren, ...	4
			100	Wayne, ...	5
				Wyoming, ...	4
					——
					100

LIST OF LOCAL FARMERS' INSTITUTES HELD BY THE DEPARTMENT OF AGRICULTURE DURING THE YEAR ENDING MAY 31, 1897.

SEASON OF 1896–97.

County.	Place.	Date.
Adams,	Arendtsville,	Nov. 16.
	East Berlin,	Nov. 17-18.
	Gettysburg,	Feb. 12-13.
Allegheny,	Montour Church,	Jan. 11-12.
	Bakerstown,	Jan. 15-16.
	Green Tree,	Jan. 13-14.
Armstrong,	Kellersburg,	Dec. 28-29.
	Worthington,	Dec. 30-31.
	Kittanning,	Jan. 2.
Beaver,	New Sheffield,	Dec. 2.
	Hookstown,	Dec. 3-4.
	Darlington,	Dec. 5.
Bedford,	Charlesville,	Feb. 1-2.
	Osterburg,	Feb. 3-4.
	Alum Bank,	Feb. 5.
Berks,	Joanna Heights,	Aug. 26-27.
	Fleetwood,	Jan. 13-14.
	Shoemakersville,	Jan. 15-16.
Blair,	Hollidaysburg,	Jan. 27-28.
	Bellwood,	Jan. 29-30.
Bradford,	Wyalusing,	Nov. 9-10.
	Athens,	Nov. 11-12.
	Canton,	Nov. 13-14.
	Troy,	Nov. 16.
Bucks,	Langhorne,	Jan. 4-5.
	New Hope,	Jan. 6-7.
	Pineville,	Mar. 6.
	Springtown,	Mar. 8-9.
Butler,	West Sunbury,	Dec. 18-19.
	Saxonburg,	Dec. 21-22.
	Butler,	Dec. 23-24.
	Wilmore,	Jan. 20-21.

County.	Place.	Date.
Cambria,	Ebensburg,	Jan. 22-23.
	Carrolltown,	Jan. 25-26.
Cameron,	Emporium,	Dec. 30-31.
Carbon,	New Mahoning,	Dec. 16.
	Weatherly,	Dec. 17.
Centre,	Pine Grove,	Aug. 22.
	Milesburg,	Mar. 3-4.
	Stormstown,	Mar. 5-6.
Chester,	West Grove,	Dec. 28-29.
	Atglen,	Dec. 30-31.
	Cochranville,	Feb. 27.
	Phoenixville,	Mar. 1-2.
Clarion,	Greenville,	Feb. 27.
	Sligo,	Mar. 1-2.
	Edinburg,	Mar. 3-4.
Clearfield,	Kylertown,	Feb. 17-18.
	Mehaffey,	Feb. 19-20.
Clinton,	Phelps' Chapel,	Dec. 23.
	Mill Hall,	Dec. 28.
	Lamar,	Dec. 29.
Columbia,	Numidia,	Feb. 17-18.
	Orangeville,	Feb. 19-20.
Crawford,	Conneaut Centre,	Feb. 9-10.
	Atlantic,	Feb. 11-12.
	Titusville,	Mar. 10-11.
	Meadville,	Mar. 12-13.
Cumberland,	Williams Grove,	Aug. 24-25.
	Mechanicsburg,	Nov. 4-5.
	Shippensburg,	Nov. 6-7.
Dauphin,	Hummelstown,	Feb. 5-6.
	Gratz,	Feb. 8-9.
Delaware,	Media,	Dec. 22.
	Concord,	Dec. 23.
	Haverford,	Mar. 3.
Elk,	St. Mary's,	Jan. 11-12.
Erie,	Corry,	Feb. 4-5.
	Wattsburg,	Feb. 6-8.
	McKean,	Mar. 15-16.
Fayette,	Uniontown,	Nov. 10-11.
	Waltersburg,	Nov. 12.
	Hopewell,	Nov. 13-14.
Forest,	Tionesta,	Jan. 18-19.
Franklin,	Chambersburg,	Nov. 12-13.
	Waynesboro,	Nov. 14.

County.	Place.	Date.
Franklin,	Welsh Run,	Feb. 10.
	Marion,	Feb. 11.
Fulton,	McConnellsburg,	Nov. 9-10.
	Hustontown,	Nov. 11.
Greene,	Waynesburg,	Nov. 23-24.
	Carmichaels,	Nov. 27-28.
Huntingdon,	Warrior's Mark,	Mar. 8-9.
	Orbisonia,	Mar. 10-11.
Indiana,	West Lebanon,	Jan. 4-5.
	Indiana,	Jan. 6-7.
	Cookport,	Jan. 8-9.
Jefferson,	Grange,	Feb. 23.
	Paradise,	Feb. 24.
	Allen's Mills,	Feb. 25.
	Mt. Pleasant,	Feb. 26.
Juniata,	McAlisterville,	Feb. 10-11.
	East Waterford,	Feb. 12-13.
	Walnut,	Mar. 5-6.
Lackawanna,	Clark's Summit,	Dec. 7.
	Fleetville,	Dec. 8.
	Tompkinsville,	Dec. 9.
	Moscow,	Dec. 10.
Lancaster,	Black Barren Springs,	Sep. 9-10.
	Marietta,	Sep. 11.
	Rutland Park,	Sep. 12.
	Quarryville,	Nov. 30., Dec. 1
	Strasburg,	Feb. 20.
	New Holland,	Feb. 23-24.
	Christiana,	Feb. 25-26.
Lawrence,	Edenburg,	Dec. 7-8.
	East Brook,	Dec. 9-10.
Lebanon,	Richland,	Feb. 1.
	Jonestown,	Feb. 2.
	Palmyra,	Feb. 3-4.
Lehigh,	Fogelsville,	Jan. 18-19.
	Hosensack,	Jan. 22-23.
	Slatington,	Jan. 25.
Luzerne,	Dallas,	Nov. 4-5.
	Lehman,	Nov. 6-7.
Lycoming,	Hughesville,	Feb. 25-26.
	Montgomery,	Mar. 1-2.
	Montoursville,	Feb. 27.
McKean,	Eldred,	Jan. 7.
	Smethport,	Jan. 8-9.

County.	Place.	Date.
Mercer,	Mercer,	Dec. 11-12.
	Greenville,	Dec. 14-15.
	Sheakleyville,	Dec. 16-17.
Mifflin,	Belleville,	Feb. 6.
	Lewistown,	Feb. 8-9.
Monroe,	Shawnee,	Dec. 11-12.
	Tannersville,	Dec. 14-15.
Montgomery,	Pennsburg,	Jan. 8-9.
	Collegeville,	Jan. 11-12.
	Lansdale,	Mar. 10-11.
Montour,	Washingtonville,	Feb. 23-24.
Northampton,	Moorestown,	Jan. 20-21.
	Nazareth,	Jan. 29-30.
	Farmersville,	Jan. 26.
Northumberland,	Elysburg,	Dec. 2-3.
	Montandon,	Dec. 4-5.
Perry,	Landisburg,	Dec. 15-16.
	Duncannon,	Dec. 17-18.
Philadelphia,	Bustleton,	Jan. 13-14.
	Philadelphia,	Dec. 19.
Pike,	Milford,	Nov. 28.
	Dingman's Ferry,	Nov. 30.
Potter,	Ulysses,	Jan. 2-4.
	Coudersport,	Jan. 5-6.
Schuylkill,	Ringtown,	Dec. 18.
	Orwigsburg,	Dec. 19.
	Friedensburg,	Dec. 21.
	Pine Grove,	Dec. 22.
Snyder,	Beavertown,	Dec. 10-11.
	Freeburg,	Dec. 12-14.
Somerset,	Friedens,	Sep. 12.
	Somerset,	Nov. 4-5.
	Myersdale,	Nov. 6-7.
Sullivan,	Colley,	Jan. 27.
	Forksville,	Mar. 18-19.
Susquehanna,	New Milford,	Nov. 17-18.
	Springville,	Nov. 19-20.
	Montrose,	Nov. 21.
	Harford,	Nov. 23.
Tioga,	Mansfield,	Jan. 29-30.
	Wellsboro,	Feb. 1-2.
Union,	Allenwood,	Dec. 7-8.
	Lewisburg,	Dec. 9.
Venango,	Emlenton,	Mar. 5.

County.	Place.	Date.
Venango,	Franklin,	Mar. 6.
	Dempseytown,	Mar. 8-9.
Warren,	Ackley Station,	Jan. 13-14.
	Sugar Grove,	Jan. 15-16.
Washington,	Canonsburg,	Nov. 19-20.
	Centreville,	Nov. 21.
	Burgettstown,	Nov. 30.
	Florence,	Dec. 1.
Wayne,	Damascus,	Dec. 1-2.
	Lake Como,	Dec. 3-4.
	Pleasant Mount,	Dec. 5.
Westmoreland,	Mt. Pleasant,	Nov. 16.
	Greensburg,	Nov. 17.
	Claridge,	Nov. 18.
	Manor Station,	Jan. 18.
	Latrobe,	Jan. 19.
Wyoming,	Tunkhannock,	Jan. 22-23.
	Forkstown,	Jan. 25-26.
York,	Glenville,	Nov. 19.
	Dover,	Nov. 20-21.
	Loganville,	Nov. 23-24.
	Windsor,	Feb. 17.
	Hellam,	Feb. 18-19.
	Delta,	

SUMMER INSTITUTES.

Centre,	Pine Grove,	Aug. 22.
Cumberland,	Williams' Grove,	Aug. 25-26.
Berks,	Joanna Heights,	Aug. 26-27.
Lancaster,	Black Barren Springs,	Sep. 9-10.
	Marietta,	Sep. 11.
	Rutland Park,	Sep. 12.
Somerset,	Friedens,	Sep. 12.

SAMPLE PROGRAM.—This Sample is Designed as an Aid to Institute Managers in making up their Programs.

Program

OF THE

......................County

Farmers' Institute

TO BE HELD UNDER THE AUSPICES OF

Department of Agriculture

of Pennsylvania.

In......................Hall,

...............Pa.

On Friday and Saturday,

November 5 and 6, 189 .

Exercises Public and Free.

Everybody is Invited. . . .

ORDER OF BUSINESS.

Fruit Growers' Session.

Wednesday afternoon, November 5, 1.30.

Presiding officer, ...

1.30. Music.
Prayer.
Address of Welcome,
by ....
Response,
by ....
2.30 Potato Culture,
by ....
Discussion opened by ....
3.30 How to Grow Small Fruits,
by ....
Discussion opened by ....
4.30. Adjournment.

Educational Session.

In the Interest of Education for Farmers and Their Children.

Wednesday evening, November 5, 7.00.

Music.
7.15. What is the Proper Education for Country Children?
by ....
Discussion opened by ....
7.45. Should we Have Graded Schools in the Country?
by ....
Discussion opened by ....
8.30. Should we Have a Re-distribution of the School Funds Appropriated by the State?
by ....
Discussion opened by ....
9.15. Ought There to be Township High Schools?
by ....
Discussion opened by ....
10.00. Adjournment.

General Farming Session.

Thursday morning, November 6, 9.00.

The Question Box.
9.30. Dairy Feeding,
by ....
Discussion opened by ....
10.30. Fertilizers, Home and Commercial,
by ....
Discussion opened by ....
11.15. Market Gardening for Profit,
by ....
Discussion opened by ....
12.00. Adjournment.

Thursday afternoon, November 6, 1.30.

The Question Box.
2.00. How to Build a Good Road,
by ....
2.45. Sugar Beet Culture,
by ....
3.30. Clover as a Crop,
by ....
4.00. The Silo,
by ....
4.30. Adjournment.

Ladies' Session.

In the Interest of Country Homes.

Thursday evening, November 6, 7.00.

7.00. Music.
7.15. A Model Country Home,
by ....
7.45. The Quality and Preparation of Food,
by ....
8.15. Heating, Lighting, Ventilating and Sanitary Arrangement of Country Homes,
by ....
9.00. The Yard and Garden,
by ....
9.30. The Care of the Sick,
by ....
10.00. Adjournment.

SPECIAL NOTICE.

The foregoing order will be followed as closely as possible, but other exercises will be introduced, if found desirable.

Speeches, essays and papers ought not to exceed twenty minutes. The papers, when read, are considered the property of the Department of Agriculture.

Although these institutes are designed and conducted for the education and advantage of farmers, yet all who are interested are invited to attend, and it is hoped that they will show their appreciation, not only by being present at the meetings, but also by taking part in the discussions.

ASK QUESTIONS.

A question box will be kept upon the secretary's desk, and all are invited to place therein such questions as they may wish to have discussed during the session. At the proper time, designated by the meeting, these questions will be referred to some one for answer, or brought up for general discussion.

All granges, alliances, agricultural societies and kindred agricultural organizations are specially invited to attend.

For further information, and for programmes, address,

Name, ...

Address, ...

Chairman of the Board of Institute Managers for ——— County.

Local Committee.	Committee on Questions.	County Board of Managers.
Wm. Stevens, Address,..............	William Stover, Address,..............	J. A. Walker, Address,..............
Mrs. Jane Weily, Address,..............	Miss Jane Miller, Address,..............	Wm. Cedars, Address,..............
Miss Emma Stone, Address,..............		John Williams, Address,..............

MEANS OF ACCESS.

Trains on the B. C. R. R. arrive from the east at 8.30 a. m and 5.19 p. m.; from the west at 9.40 a. m and 9.38 p. m.

On the P. R. R. trains from the east arrive at 4.52 and 9.54 a. m. and 4.32 p. m.; from the west at 10.18 a. m. and 5.08 and 9.23 p. m.

PAPERS READ AT FARMERS' INSTITUTES,

DURING THE SEASON OF 1896-97.

Only a few of the large number of excellent papers read at farmers' institutes can be published in this report, owing to the lack of space.

DAIRYING.

WINTER VS. SUMMER DAIRY.

By L. H. BALL, *Montrose, Pa.*

There are a great many conditions, not theories, that confront us when we take this question into consideration.

Are you so located that your milk must be made into butter, either at home or at some creamery, and put upon the market at the ruinous prices of late years? If this be your case you would do well to leave winter dairying alone.

Cows giving milk in cold weather require a variety of grains different from those we can grow upon our own farms, and in such abundance that we can never hope to grow enough, even were it profitable to grow them at all.

We know there are creameries all over the great central west, furnished with milk from cows as good as ours, with mill-feed at their very doors to be had almost for the asking, and we certainly are not so lost to common sense as to suppose we can pay freight on grain for 1,500 miles and compete with those parties who feed it on the spot.

But perhaps most of us are within easy reach of a milk station, and although milk at 2½ cents is low, it is at least 50 per cent. better than 20 cent butter. Again, are you within a mile of a depot or siding, so the hauling of the feed may not consume the profits?

Have you a No. 1 dairy? Have you an abundance of pure water, not too cold? And have you a good, comfortable, commodious, well-lighted and well-ventilated stable? Lacking any of these requisites, winter dairying will hardly pay.

You see there is so much more at stake in winter than summer, every spear of fodder, every kernel of grain the cow consumes, costs either labor or money, and we have many expenses to cover before the profit, if there be any, comes in.

Since April 1, 1893, I can tell how many quarts of milk we have sold each month, the price per quart, and weight and price per pound of veal calves sold.

Our cows come in one-half in spring, other half in early fall, and not a year but November, December and January have brought us nearly twice as much as June, July and August or fully as much after having paid for all grain consumed; and, besides, the fall cows on grass next June will give nearly as much milk as the cow that drops her calf in March, while the cow to calve in March gives but little milk at the season it is worth the most.

Our dairy, consisting of 10 farrow and 6 fall cows (not just fresh), brought us returns amounting to $112.22 for December just past, fed mostly on bought feed at a cost of $46.50. Fed roughage very sparingly, as our crop of fodder was light.

We have no silo, hence are badly handicapped, but lay great stress upon the fact that to succeed we must feed a strictly balanced ration, neither too wide nor too narrow as the terms go in dairy parlance.

Our State Experiment Station Bulletins tell us that a nutritive ratio of 1 to 6 is about right for a cow in milk, and although we give a change of feed frequently and compound different rations, we still hold very closely to that mark. One pound protein to six pounds carbohydrates.

An experienced dairyman would hardly feed a fleshy cow corn meal and timothy hay, expecting profitable returns at the milk pail, nor yet a cow already thin an excess of bran, gluten or buckwheat, thinking to build her up, still he might go wrong many times and entirely without excuse, since our Experiment Stations furnish entirely free, abundant information that all may understand.

Our best cow, six weeks in milk, for the week ending December 26, gave an average of 20 pounds, 12 ounces each milking, or a little over 19 quarts per day. Her rations were 5 lbs. each nicely cured millet, and hay from oats cut green; 9 lbs. bran, 6 lbs. of gluten, and 3 lbs. corn and rye chop per day. But few cows can assimilate that amount of feed, and feeding it, one must watch results closely. In feeding use good ordinary horse sense, and in case of question as to amount, give the cow the benefit of the doubt and put in a little more bran.

Do with your cows as you please, but there are some things I would not dare do, trusting to the dairy for a livelihood. I would not en-

courage her with a stool or heavy boot. I would not keep a cow that was no good after a fair trial. Her little mess always seems to reduce the average of the herd. I would not leave them out on a cool day just to make them tough. There is no milk to be had from a northwest gale. I would not, when feeding bran from a pint cup, carry a shingle along to strike the top off level. You can guess near enough and save valuable time. I would not forget to give each one a little salt in her morning feed. It makes the feed more palatable, creates a little thirst and is a perfectly legitimate way of increasing the contents of the milk can. And last, but not least, I would not exercise my cows with a dog.

I am always sorry for the man with farm and buildings so arranged that he must needs keep a so-called cow dog to round them up, and much more sorry for the cows. Such a man certainly missed his calling, is beyond his depth; should have been a journalist or congressman.

A man who thinks his cows need daily exercise should provide a good safe place where they could hold sprinting, wrestling and boxing matches all their own. A gymnasium with properly qualified instructors would be cheaper, eventually, than a mischievous dog.

I do not, as Bill Nye once wrote, tip my hat to a cow, nor am I like the traditional old woman who kissed her cow; but I do hold her in high regard as one of a class of animals most invaluable in providing sustenance for the human race, so that, at all times, I am inclined to treat kindly one of the most useful animals that God ever committed to the not over tender mercies of man.

DAIRY MANAGEMENT IN CONNECTION WITH MIXED FARMING.

By H. A. FULLERTON, *Edenburg, Pa.*

This is a branch of agriculture that throughout our community is followed more generally than any other, and, therefore, one of the live questions with us.

Probably the first thing to consider is: Why should we follow dairying in connection with our mixed farming? In mixed farming we have a variety of crops for which we must find a market. If we sell all our products and only look after the cash received, we soon find

our farms in such a condition that we can no longer produce a paying crop, but we should always try to produce the greatest amount possible from the given area cultivated.

Therefore, since we desire to have our farms improve, we must return more than we take from them. In what way can this be done? By supplying the elements required for plant food. These we find either in barnyard manure or commercial fertilizer. Since we have a great amount of roughage on hand, this we can dispose of through some kind of live stock and thus secure our plant food. What shall this be, to bring us in the greatest gains for the capital invested? This we find, I think, in the dairy cow more than any other, first, on account of their ability to consume and assimilate a greater amount of it, and, second, because, by the sale of their product, either butter or milk, and especially butter, carries away the least amount of fertility.

Don't understand me to think that every one should add a dairy, not by any means. Someone has said "there are men who can not run a wheel-barrow successfully;" just so with the dairy.

A cow, in order to do her best, must not be dogged, scared, run about, kicked or hammered with the milking stool, but must be handled gently and kept quiet. If you would be successful, attend to them yourself or watch closely while it is being done. Franklin said: "The eye of the master is often worth more than both his hands."

He must have a love for his work and not go to town and spend his time loafing in the grocery store or discussing politics on the corner for an hour after milking time. He must be a man of regular habits, have a certain hour to milk, morning and evening, and milk at that time. The man who runs a dairy successfully must be the most methodical of farmers. Yet with mixed farming this, at times, is hard to do, especially when the weather is threatening and the corn ground almost ready for the planter, or two or three tons of hay are lying in the field, but it must be done. During the past summer we milked at 5, morning and evening. This seems early summer evenings, but by having supper at 4.30 it breaks in the least on a person's work in the field.

Don't keep more cows than you can care for and feed properly. Of course, in mixed farming, we don't expect to buy any feed, but raise it; we also expect to feed all we raise, wheat and timothy hay excepted. These are made a cash crop. I consider it economy to sell some corn or oats and replace it with bran or oil meal. My experience with bran has been far from a success. I doubt if oil meal fed in connection with corn and oats chop can be beaten for cow feed unless one has a silo. Yet how few of us have them unless we make dairying a specialty.

As we have more time in winter, I think it better to have the most of our cows fresh during the fall or early winter months. Then the question arises, how shall we feed and care for them? I feed corn and

oats chop and oil meal for a grain ration, giving enough oil meal to help make a standard balanaced ration, which is 1 of protein to 5.5 carbohydrates.

However, I have had as good success when a wider ration was used, and for roughage use clover hay and corn fodder. The fodder is cut and the grain mixed with it. This is left stand twelve or twenty-four hours before being fed, which softens the crude fiber and makes it more palatable.

Some may think this too much work; if it is, then feed it dry, but by all means cut your corn fodder. The husks and a part of the stalks will be eaten and the remainder is much more easily handled in the stable. This refuse makes good bedding. The pith absorbs the liquid manure, which is more valuable than the solids. Then don't throw it out under the eaves to wash away. If we keep the cow to use up our roughage and convert it into plant food, let us take care of it. A good cow can be made to more than pay her keep and the care given her without taking the manure into consideration.

Did you ever make an estimate of how much it cost to keep a cow just one day? If not, go home, weigh her feed to-morrow and see what it amounts to at market price; keep her milk by itself and churn it, then you know what it costs to produce that butter, and also whether that cow is a robber or a mortgage lifter. I know some of your cows will be a surprise to you.

Our milk is all weighed as it comes from the cows, a record kept and each cow's milk tested occassionally, either by the churn or Babcock test. This shows at the end of the month just what each cow has been doing. Some will do better at first than others, but others will keep it up throughout the year. This method shows, at the end of the year which is the profitable cow.

By all means keep your cows in out of the storms and cold winds. After you have been weighing your milk you will see quite a difference.

Don't worry about exercise. I have known cows to make excellent records that were not out from fall to spring. On pleasant days they enjoy being out and I generally like to satisfy them, but don't keep them out after they come to the door and want in. A cow can not do her best when exposed to cold rains and winds. The food given her goes first to keep up the animal heat and what is not used for this to the production of milk. Is it not cheaper to keep up this heat by a warm stable? Certainly it is. I am remodeling my stabling and will tell how it will be when completed. It will be double boarded with paper between, and as milk is mostly water, a cow can not do her best without a sufficient supply and this she often does not get when turned out in the cold to drink. A watering device will be put in, so that water will be constantly before them. The gutter behind the cows will be water-tight and the manure from this and

the horse stable wheeled into one pile and kept under cover until taken to the field.

In mixed farming some sheep are generally kept. If the summer cow pasture is located near the barn and the pen kept dark and cool, you will always find the cows there during the heat of the day and out of the flies. You will also find your pail of milk heavier. Don't turn out on pasture too early in the spring. Feed some grain all summer and arrange for some soiling crop in case of short pasture. For this purpose, clover, cut green, or hay and sweet corn are very easily raised and as good as any.

DAIRY FEEDING.

By HARRY ST. CLAIR, *Indiana, Pa.*

By "feeding the dairy" is meant the providing and distributing that which is necessary to supply the wants of the dairy, to make it productive. I fear that we very often underestimate the importance of the dairy interest.

Not having at hand the data giving the value of the output of the dairy products of our own State, I will give you that of Iowa. Commissioner Boardman gives the value of the output of that state at the enormous sum of $42,000,000 annually, which is more than the total silver product of the Nation, over which the people were so excited in the late campaign.

"Thus you see that when the cow attends steadily to her work, she rolls in the wealth in a way that ought to make the calamity howlers ashamed." If the single state of Iowa can create so much wealth in one year through her dairies, should not we, here in Pennsylvania, take courage and try to help swell the output of the old Keystone State. Hoard's Dairyman states that a single county in the state of Wisconsin received from her creameries alone $300,000.00.

Now that we have the cow, what shall we do with her? Are we determined that she must produce milk or butter for us at such a cost that we can realize a profit from our investment? or is it our purpose to buy her and then, by our treatment of her, say, now you must hustle, find what you must have to eat, get what you want to drink and shelter yourself the best you can; I shall see you at least twice a day and you must yield me a paying quantity of milk? If you don't, you are a fraud and not worth keeping. Or is it our purpose to fur-

nish her the most comfortable quarters possible, see that she does not want for anything that would make her comfortable, contented and kind. Are you in sympathy with her? Are her interests your interests? Do you like cows? Do you like to work with them, feed, water, milk them? If so, you ought to make dairying pay. If not, you had better find or follow some other branch of agricultural work.

Now that the cow and you are both comfortable and contented you are ready to begin to work. She stands in her clean, comfortable quarters and as you enter she looks towards you with an expression of countenance that ought to sweeten any temper, and here is just the place to begin to feed the dairy.

The all-important question to every one owning and feeding a cow is, how can I realize most from her? This is answered by inquiring what shall I feed her that will make her do her best, and cost me least?

To us Indiana county farmers and dairymen, the question at once assumes a personal character. You say, I take corn and oats, buckwheat, get them chopped together and then I feed her two quarts of this meal twice a day, and all the straw and corn fodder she will eat and she doesn't do a bit of good. Something is wrong with her, hollow horn, perhaps. On grass, last summer, she did amazingly well; now she has fallen off. Have you provided anything to meet her natural wants in the changed conditions from nutritious grasses to dried, tasteless, woody straw and corn fodder? Have you done anything to make these last named articles of food palatable to her, to sharpen her appetite, make her eat until she appears full like she does when she comes from the pasture? Have you ever noted how much she will gain in her flow of milk if you can but get her to fill herself? If you have, and there was a gain, is it not worth while to spend a little time in studying how you can make her go on improving and increasing her product? Some one has said that we ought to feed our cows to their full capacity. How many of us can do that? If you think you can, tell us when your cow is doing her best for you? If you cannot, you certainly can tell that she is not doing what she ought to do, or as well as she has done. Then what is the trouble? Are you feeding too much corn? Is your cow growing fat and still not improving in flow of milk? Had you not better try something else with the corn, as for example linseed or cotton-seed meal?

Did you ever try cutting corn fodder? If so, you will find that your cow will not eat it up clean. Did you ever try packing it in a tight box and mixing a little bran or chop with it and then wetting the whole mass, letting it stand from one feed to the next?

Did you ever try feeding silage? Do you have a silo, and, if so, did you ever succeed in getting your neighbors to come in and see it while you were filling it or while you were feeding the silage? Did you never hear any of them say, well, I wouldn't feed that stuff to my cows if I had it? If you have silage did you ever try feeding with it

flax-seed meal or cotton-seed meal, or did you ever try either of these with bran on your dry straw or corn fodder? Do we really, earnestly and honestly study to find out what will make our cows do the best possible, or do we say: Oh, I won't try that stuff; neighbor Smith feeds it and I won't feed what he feeds.

If you will pardon me, I will give you a little of my experience. I am now feeding from a silo for the fourth year. We have a wooden silo, built in the barn. The first year we were fearful lest we should lose everything we put in it. Some of the neighbors exclaimed, what a pile of manure they will have to haul from that big box. We did have a big pile of manure, but it had all passed through the cows first. We made a mistake the first year in selecting our poorest corn for the silo. We have been learning something new every year in regard to it. One is that we need to let our corn become more nearly matured before cutting, and this greatly improved the quality of the silage.

This year a portion of our silage corn was badly frosted, but it nevertheless comes out in splendid condition.

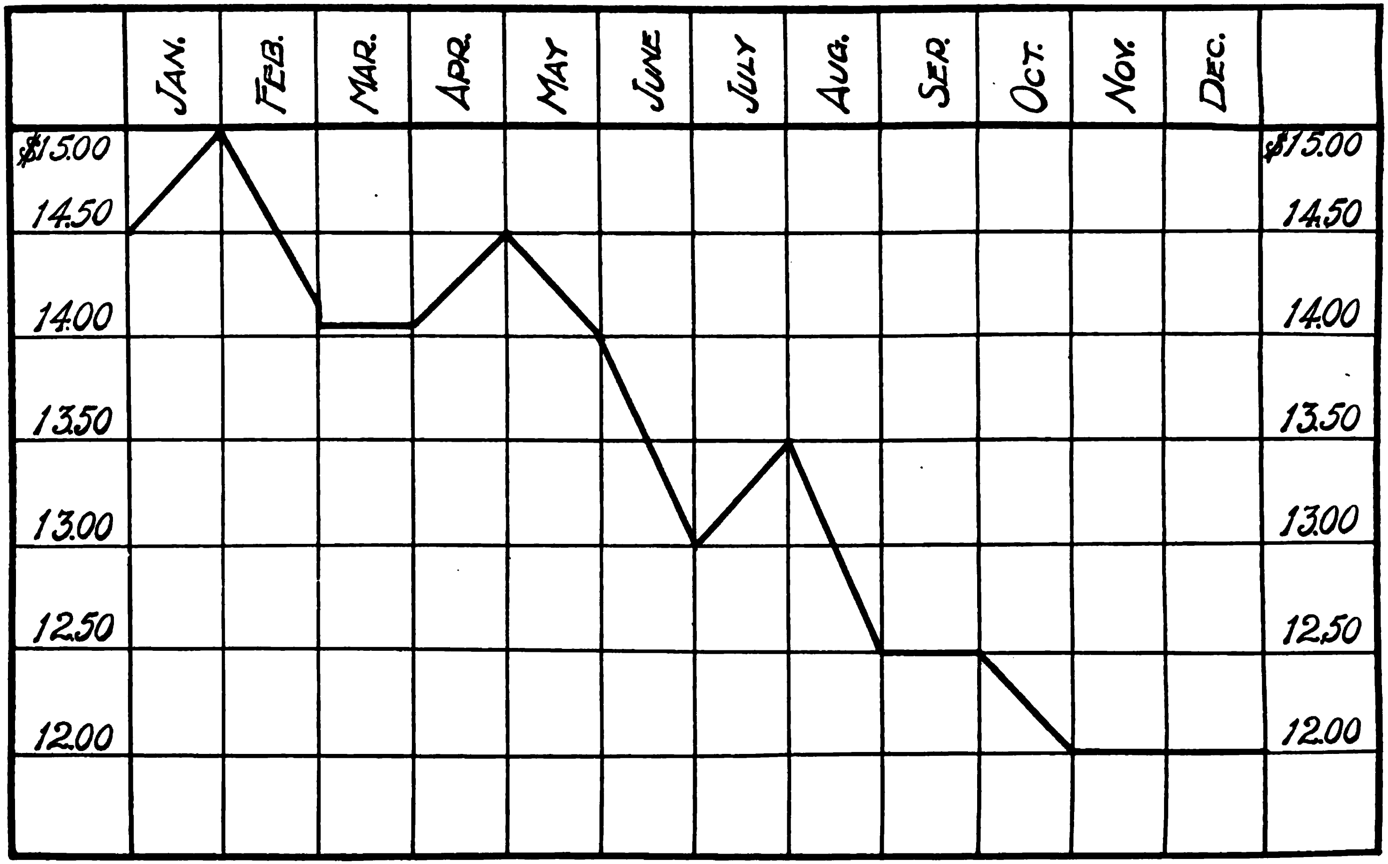
We have used cotton-seed meal extensively with most satisfactory results. We have also used cotton-seed hulls with equally good results. We cut all of our corn fodder and give the cows a basketfull of it and then put on top of it a candy pail full of ensilage. We will find little of anything left. When the silage is done we will steam the cut fodder. We find timothy hay very expensive to feed to milk cows and but little better then wheat straw.

Let us all read more and study what we do read. Be sure you read some good daily paper and then put into practice the knowledge that you thus obtain.

DAIRYING.

By Hiram C. Wickert, *Spinnerstown, Pa.*

Ladies and Gentlemen: Dairying is one of the mainstays of the agricultural prosperity of our country. It is not only a source of cash income to the farmer, but, if correctly managed, will leave his fields more fertile as time passes. It is not to be supposed that a person would go to the trouble and expense to feed and care for cows unless it were profitable. I believe it to be true, however, that many a farmer keeps cows at an actual yearly loss to him. A little calcula-



PRICES OF TIMOTHY HAY, (BALED), AT PHILADELPHIA, 1897.

tion with pencil and paper will soon convince him that such is the case. In the present depression of the dairy business, it should be our aim to produce milk and butter cheaply.

You will admit that to secure this end we must work along two lines, namely, a better cow and cheaper feed. In studying dairy feeding we are at once confronted with the importance of laying stress on the individual traits of the cow as a producer of milk and butter. These traits or tendencies are some of the main factors which multiply or divide our products. In selecting cows, let us take those which show the true dairy type, and reject all those which show tendencies to lay on fat.

Mr. M. E. King, a noted dairyman of Ohio, gives his idea of a dairy cow as follows: He says "my ideal cow is slim; she is ewe-necked, is flat-ribbed, has high hips, a big paunch, is cat-hammed, has a long tail and is what is generally called raw-boned."

This description is not a beautiful one for a cow, but it coincides with that given by other noted dairymen. It was thought years ago, and was not often questioned, that the amount of butter fat in a certain quantity of milk could be changed by the amount and quality of the feed. But the dairy business has developed and we know that a certain cow is a 3, 4 or 5 per cent. cow, as the case may be, and that the per cent. of fat and other solids in her milk can not be materially changed by the feed. Assuming that this is truth, let us take it as the basis of all our work in the dairy.

Talking about this matter of selection; it occurs to me that the man who goes out to buy a cow is much like the one who invests in a lottery ticket. He may draw a prize, but the chances are against him. Not every one is a judge of the dairy cow, and it is also reasonable to think that the animals offered for sale are not wholly desirable to their owners. But you ask, how, then, can we get good cows? I answer, if you can not buy them, raise them. If it is not convenient for you to invest much money, get a good stock bull from some of the dairy breeds and use him on the best of your native cows, and grade up your herd. Thus, in time, you can, by proper selection, establish a line of milkers which, in my estimation, will go a long way towards keeping the wolf from your door. Having secured good cows, according to the best of our knowledge, we next direct our efforts to their profitable feeding. To the farmer, the feeding question resolves itself into this: How much material can I raise on an acre? This involves a study of your surroundings, in regard to the fertility of the soil and the crops to be raised thereon. It should be the object of the dairyman to produce as much as possible, all that he feeds, and he should rotate his crops on the farm with a view to that end. It is a fact, however, that corn which we grow largely and which is well adapted to our climate and soils, has an excess of sugar and starchy material, and is, therefore, not a balanced food. But we also grow the different

grasses for hay, among which clover ranks as one of the best. Clover hay analyzes high in albuminoids and is, therefore, valuable to feed along with corn, to balance the ration. We could not feed enough of it, on account of its bulk. It is, I think, economy in this case to buy some concentrated feed, like oil meal, which has the lacking element in large proportions, and feed along with what we have.

There are also the other feeds like bran, gluten meal or sugar feed which can be added to make a balanced ration.

At the present time, there is no excuse for any farmer not having the publications of some of our agricultural stations. These contain tables which show what all the different feeds are made of and explain how to compute a ration. A ration for a milk cow is given as 1 to 6. This means that the heat and force formers are six times the flesh and blood formers. Now, it seems to be plain that while such bulky feeds, having plenty of dry matter, heat and force formers, are found in abundance on most farms, some can be sold and something bought which will bring the ratio closer together. The last few years have given us a large amount of dairy lore. We read a great deal of the balanced ration, but how can the general farmer, with his limited knowledge of science, make up such a ration. Fellow farmers, we are greatly indebted to science. She blesses us in our different walks of life and I shall always be a willing pupil at her feet. Let us not forget, however, that the all-wise Creator has given us common sense, and this ought to lead us to experiment, until we have a ration, the feeding of which will prove its correctness.

I have secured good returns from a mixture of corn and cob chop, oil meal and sugar feed, mixed with cut corn fodder. In addition to this, I have fed one-half bushel of turnips per day in two feeds, and as much hay as they would eat up clean. I have found it of great benefit to feed along with the grain ration a mess of roots, pumpkins or green fodder. I believe that fed this way these succulent feeds have a value far above their chemical rates. At the present low prices of potatoes I believe they may be profitably fed to cows. Speaking of green feeds reminds us of the silo and its contents. I have seen silage praised by many able writers and but few have lifted up pen and voice against its use. Perhaps it is the most economical way of storing the corn crop and the best way of feeding it out. I have had little experience with it, but what I have seen of it has not impressed me in its favor. I do not intend to be understood though, as being against its use; on the contrary, I desire to learn from any one who has a knowledge in advance of my own. I have been asked whether "soiling" pays. This depends on the value of the land, the price of labor and the worth of your product on the market. Where land is high priced and fertile, other things being considered, I believe it pays to raise soiling crops and feed in the stable. Where, however, we have cheap land and pastures, I believe it would be better to pasture. Labor is often dear in

proportion to farm products, and is nearly always the main factor in the cost of what we produce. It is, therefore, well to consider these items before adopting any particular system of feeding. There is a large class of dairymen who feed cows with a double object. They buy a general purpose cow, that is one showing a tendency to lay on fat. They feed that cow all she can assimilate, milk her a certain time and then sell her to the buyer of fat stock. In time past, I have followed the same course when prices of fat stock ruled high. I came out right side up, but when they were low, as, alas, they often were, I felt the chill creep up my back, as I thought of the notes for those cows remaining in bank unpaid.

Now, my friends, we go into this dairy business for the purpose of making money. Our families are dependent on us for the means of existence. That mortgage which overshadows the farm ought to be paid off and at least the interest must be paid.

We, therefore, ask in all earnestness, will dairying draw us out of debt, give us the comforts of life and a competence for old age? I believe we can secure these ends by an intelligent use of the forces at our command. Don't for a moment think, though, that it is a bed of ease, whereon the dairyman makes his dollars. It is like unto the answer of the chicken man, who, when asked as to the profits of the poultry business, replied: "The price of chickens is the price of everlasting watchfulness." So with the dairyman, it is not only a hustling of his legs that is required, but also a very lively hustling of his brains.

DAIRYING.

By JAMES P. McCALMANT, *Paris, Pa.*

Without assuming to know very much about dairying, or that I can teach very much on the subject, I shall endeavor to give some of our experience and conclusions after twelve years in the business. We are apt to become idealistic when we are discussing any question. We can build up beautiful theories and give the most logical reasons why a thing ought to be thus and so, but in trying to practice them we find they will not work. There are too many circumstances arising to overset any theory or absolute rule we may adopt, either in dairying or other branches of farming. Our effort will be to give, in as plain and practical a manner as possible our conclusions.

Let any careful, prudent farmer with ordinary judgment in the selection of dairy cows and ordinary judgment in handling the product try it for a year and he will think it a pretty fair business. In 1892 we had in our dairy 23 cows, and at least 12 any two of which would fill a 5-gallon can at a milking when at their best. Some of them more than that, but, alas, in less than two years we sold one of them for $1.00 and two more for $6.00 each. No fault of ours either; there was no more room for wrinkles on their horns. Now, but three of the twelve are left and they, too, have passed from profit to expense. How many cows did we buy to get these twelve? Would say about thirty. In our most successful years we have some cows that do not pay expenses and it is in providing for these that reduces the profit of the dairy.

Can this be prevented? Can we get cows in our dairy that can always be depended on? Our experience is that with the most careful treatment they will vary from year to year. During the past fall, one of our good cows quit milking although having every appearance of perfect health. She never refused her feed or gave any other sign of sickness. They were all "off" in their milk for a day or two, we think, from eating acorns, but soon returned to their usual quantity except this one. These are some of the difficulties in the way of success in this branch of farming. In our first years of dairying we experimented some with cooked feed, using a large iron kettle, which held from 40 to 50 gallons, for cooking the feed. We found, by two trials of ten days each, some increase in flow of milk, but not enough to pay for the extra labor.

Our present system is dry feed. As milk producers, we consider bran and corn fodder the best and cheapest feed, all things considered.

For two years we have used corn and cob meal, one part; wheat bran, two parts, except in very severe weather, when we increase the meal to equal parts with bran, with an occasional feed of chopped corn and oats, equal parts, for a change. We usually feed corn fodder in the morning, and hay or oats straw at night. Would rather have bright oats straw than ripe or bleached hay.

We cut our hay before the seed forms and unless it is very heavy, put it up the same day. If half dried, we at least rake into winrow as a night's dew will damage it very materially. Many farmers pretend not to believe this and ascribe no higher motive than a desire to be first done.

Green cut hay will weigh more to the bale than ripe, and is easier masticated and digested because there is less woody fiber. It is not the amount fed, but the amount digested and assimilated that counts. For this reason, we frequently give the cows a change of feed, as a steady diet is apt to derange their digestion, when heavily fed. As regular feeding, as to time, quantity and quality is important, we always try to keep a well balanced combination before them. We have

no experience with gluten meal; have used a little oil meal, but not enough to establish an opinion.

We make no pretence to provide roots for our cows, as the labor and expense of raising, preserving and feeding roots far overbalances any good resulting from their use. We do usually raise a few turnips and pumpkins, but hardly take them into account as feed. We use no cattle powders, or sulphur, or copperas, and for five years have not had a case of garget or caked udder except from accident.

We consider a free use of salt an important matter. Beside keeping it before them we put it in the feed.

The past summer we had no convenient field to turn our cows at night but a field that was taken with ragweed. With plenty of salt fed in bran we had no trouble keeping the ragweed taste from the milk. Turnips can be fed to dairy cows in the same way without tainting the milk or butter.

We milk at about 6 o'clock, morning and evening, throughout the year. The advantages in this are, first, those having a tendency to withhold their milk, as some cows do, will give it more freely and, in a measure, the fault is overcome. Another advantage, we nearly always find them at the pasture gate at that time. Never beat or scold a cow when in the stable, even if she kicks. An application of the milk stool will very materially reduce the quantity of that milking at least and nine times out of ten she will kick harder next time. If a cow chances to set her foot in the pail, get it out as quietly as possible and empty the pail in the hog trough, as our patrons want milk, not fertilizer.

We veal most of our calves, for with ten or twelve cent milk it pays well enough. We never kill them as soon as born as some do. We do not want the milk for the first week anyway. I once asked a dairyman how soon after a cow came in he shipped the milk. He answered, about the third or fourth day. Shame, shame, on the dairyman that would do such a thing. The number of times we milk a healthy cow will in some sense determine its fitness for use, but in the name of common decency don't ship it before the tenth. It will not kill anyone before that time, but there are lots of things that won't kill us that we don't like.

There is more depending on the man than on the cow in making dairying a respectable business. Do not fear getting your milk too rich. We have been offered cows time after time and told they gave great quantities of milk, but were poor for butter. Don't buy many of that kind, you don't want them. While we do not believe that the milk from the same cow, at all seasons, is of equal richness we know it is a trait or habit of some cows to give rich milk. I have often read that you cannot feed butter fat into milk. I think but few dairymen believe this. We mostly churn our Saturday evening milk, and we get a much greater quantity of butter in winter than in

summer from the same amount of milk. Trus, our crude arrangements for butter making may have something to do with it, but we have tried both skimming and churning the whole milk, and the fact remains the same.

We give it, then, as our experience that milk does vary in richness. I should have said that those who claim that you cannot feed butter into milk, say you con feed for a larger flow of milk and thus increase the quantity of butter. To state it plainer, their theory is that a cow's milk contains so many globules or butter sacks to the square inch, and these are not increased or diminished by feed.

Do not try to work sixteen hours a day and attend to the dairy beside. We do our farm work between 8 a. m. and 5 p. m. o'clock. Milking is the first job in the morning and the last in the evening. We are often asked by those desiring to enter the business to tell them the truth, and in honestly telling them both sides of the business, they nearly always go away thinking that we are trying to keep them out. We had a man helping to husk corn, when our milk wagon went by, and he asked me how much milk there was in the wagon. I answered, 60 gallons. Then as to price. I answered 16 cents per gallon. He counted 60 times 16 cents, makes $9.60. Without asking anything about costs or circumstances he set that down as clear gain. That was on a Monday morning, with more than a day's milk. The cost of cans and wear and tear of wagons, harness and horses must also be taken into account.

No difference what goes on, the cows must be milked and cared for. Not one of our boys but would rather go to the Burgettstown Fair all day than milk cows one-half hour, and I believe they come by it honestly, too. The exposure, too, must be thought of, and no difference what the weather is like, the milk must go to market. We lay no claims to extraordinary success in dairying. I believe we have been fairly successful, comparing it with other lines of farming. Eternal vigilance is the price of success in the dairy as in any other business.

I would like to talk on some other features of dairying, such as the marketing of the product of the dairy; the great difference that exists between the price paid to the producer, and the price to the consumer.

With the experience of the past two years, I have no remedy to offer. There ought to be some plan by which the producer could get at least half the price the consumer pays. Any effort that has ever been made has been defeated, not by the milk dealer, not by the consumer, but by the producers themselves. That being the case, it is idle to discuss this feature now, but how to make a success of the dairy under the circumstances as they now exist. The prospect for this winter is very discouraging.

Prices were never so low. They will not always remain so. Feed is plenty and cheap. Then let us bridge over these difficult times by

giving more thoughtful care to the little things. We found during the past two winters that we could keep our stock on almost half the hay we thought they needed formerly. We must not forget, however, that very much of the feeding value of our feed crops for this year is already lost by excessive rains, and without a continual practice of economy, there will be less hay for sale next spring than last. The man that takes the best care of his stock now, will be best prepared for the prosperous times, if they come.

Question.

"How much do you feed?"

No absolute rule can be given as to amount fed to each cow (grain feed). That is a matter resting altogether on the habits of the cow.

We study the cow individually. This is of vast importance, as with repeated trials we find some cows will give as much milk per day on four quarts as with ten quarts. We might say more, for with the greater quantity some cows will fatten and a decrease in flow of milk will follow. Others will fail to digest and assimilate the greater quantity and the same result follows. This being true, we would emphasize the importance of study, care and common sense in feeding a dairy cow.

Explanatory Statement of Condition of Herd During Six Months Reported.

1st. Three of cows were old and had no calves since the year before.

2nd. Four of them came in during the months reported.

3d. Five came in during July, August and first week in September.

4th. Reason for not reporting up to time of institute. We purchased more cows at end of six months and the difficulty of keeping the twelve cows separate product would have been too great.

5th. At no time during trial were they all giving milk.

6th. The product of the twelve cows for the next four months averaged higher, as at the last all of them were milking.

Quality of Milk, Churn Test.

Saturday, October 31, and part of November 1, 23 gallons of milk made 9 lbs. of butter.

Saturday evening, November 21, 13 gallons milk, 4 lbs. 9 oz. butter.

Quantity produced, first six months of 1896, from 12 cows, 5,360 gallons; average per cow, 446 gallons, average price per gallon, 11¼ cents, gross; calves sold, 4, amounting to $31; total average per cow for six months, $52.83; daily average per cow, $2.41.

Quantity fed in winter months, mixture, one part corn and cob meal, two parts bran, by measure; eight quarts per cow, twice a day; all the cornfodder they will eat clean; hay, usually a mixture of

timothy, clover and native grasses, about all they will eat clean, if we have it plenty. In addition to these we feed all surplus vegetables, roots and apples, such as cabbage, turnips, beets, potatoes, at such times as we think they will be most useful.

Stable warm enough to prevent freezing when closed; platform stalls with 6-inch drop; average width of stalls, 4 feet; depth, 4 feet 10 inches; front of manger, 16 inches high; back, 3 feet.

THE DAIRY FARM.

By C. F. Beck, *Jacobus, Pa.*

If one has the proper knowledge necessary to conduct a dairy farm he wants one well supplied with constant running water, convenient for stock, and conducted into the dairy house. This, I consider the most important requisite; the foundation of all successful dairying. I would no more think of going into the dairy business on a farm without this never-failing living element, than I would build a flour mill in this borough to run by water power, or a saw mill on our western prairies, or go into potato speculation, at present, in the city of York. Next in importance is a naturally rich and fertile soil, that will produce a luxuriant growth of grass and other fodder necessary for the support of a fair dairy stock. A farm possessing these important requisites will make a "dairy farm" wherever it may be.

You have heard of cows yielding 300 pounds of butter per year. Such a cow is the next thing to a life insurance company where the members are to pay in but draw much more than they deposit.

But such a yield we dare not take as the unit of reckoning, for dairying is not an exact science like arithmetic. There is only one principle in arithmetic that will hold good in dairying; and that is that "naught from naught will give nothing." I think that the time is here that our arithmetics require a supplement relative to dairying, with questions like the following: If one cow gives 300 pounds of butter per year, how many will ten cows yield? Every dairyman, as well as the average school boy, would answer, ten times 300 pounds. But that is not correct, according to the science of dairying. In this supplement, at the top of the questions similar to the above, I would put the following rule to aid the scholars to derive the proper results, viz: As you increase the number of cows, decrease in proportion the average yield per capita. Then I would give the solution to the above

question as follows: If one cow gives 300 pounds of butter in one year, ten cows, which are equivalent to nine cows giving 300 pounds each, will yield nine times 300 pounds, or 2,700 pounds, and, also, that twenty cows which are equivalent to seventeen will give seventeen times 300 pounds, or 5,100 pounds. But you won't find these cows among all breeds. I would no more expect to find them among the Angus or Galloway breeds than I would to find mulberries on the grape vine, or to draw fresh and salt water from the same well, for there are no milk giving qualities in their construction. On the other hand, mark the sharp contrast in the build and form of the Guernseys, Alderneys or Jerseys. It is as distinct as that which exists between the African and the Red Man of the Forest. These are the breeds that will always stand the test, and, consequently, the breeds that we must have on the dairy farm, if we want to make the most and the best butter. There are, of course, individual good milkers among some other breeds, but they are scarce. But some say, these larger breeds bring more money, if you want to sell them. I say, that a dairyman has no business to sell a good cow as long as she does well and he remains in the business, and if she is kept till she is wore out, the realization of her products will be so great that the dairyman can well afford to sell her at quite a sacrifice. You would learn this also in the proposed supplementary arithemetic on dairying. Here's the question: If an ordinary cow that is worth from $30 to $40 will make from 125 to 150 pounds of butter per year, how much ought a cow be worth that will make over 300 pounds? This is a mental question; I will, therefore, leave it for you to solve and will take up the next question. How many cows ought to be kept on the dairy farm? I say no more than can be fed properly, and that depends more upón the condition of the soil than upon the size of the farm. I think that if a man will study arithmetic first he will not be misled by the promise of big results, but will start gradually, save all the manure and put it on the land so as to make it still more productive. As the demand for his dairy products increases, he can then add more cows to his herd to meet the demand.

Always increase the feed in proportion to the number of cows added. Many farmers thin their corn, so as to give the remaining stalks all the nourishment and insure them a more abundant harvest. The same good results would follow among farmers, if they would thin out the poorest cows and give the food and nourishment they consume to the rest of the herd. Never expect heavy yields from light feeding. A cow has laws of her own which she executes with great exactness. She has put a fine on her owner for all improper food, care, and treatment. And no sooner do these things occur than she will deduct her fine from the farmers proportional according to the treatment received and the farmer is bound to pay it. While we can have good feed without good cows, we cannot have good cows without giving

them plenty of good feed. It takes a combination of the two to work to advantage and to lead to success.

What is good feed? All grains, ground, are good feed, when properly fed. But one alone does no more make a perfect ration for a cow than one article of food would for man. No doubt some of you thought, on Christmas, that turkey tasted very good, and no doubt it did. But if you have nothing else to live on for some time but turkey, what would be the result? Man wants and requires a variety of food; so does the cow. She ought to have a well balanced ration. Since some kinds of food possess medicinal properties, one must know how to use them. For instance, linseed meal has a laxative effect and cotton-seed meal a constipating effect. If you feed either too strong, the result will be unfavorable and you will lose confidence in them. If we feed the two together, about four pounds of each to about five pounds of bran, we have a strong nitrogenous food, and what I claim a perfect ration, and considering their manurial value also one of the cheapest. Let us compare the feeding and manurial value of a few feeds, since manure is another very important item on the dairy farm.

	Feeding Value.	Manurial Value.
Linseed meal,	$21 40	$20 30
Cotton-seed meal,	23 22	24 03
Corn meal,	16 98	5 69

In feeding only about 20 to 25 per cent. of the fertilizing constituents of feed will be lost in passing through an animal. But we will make it high, and say one-half, and we will see what results we will obtain by adding one-half of the manurial value to the feeding value. Linseed meal would be worth $31.55 per ton; cotton-seed meal, $35.24; corn meal, $19.83. Now, which of these is the cheapest, considering their full value when linseed meal can be bought for $20.00 per ton, cotton-seed meal at $22.00, corn meal at $18.00? Think over this, and see whether it would not be wise to sell some corn and buy linseed and cotton-seed meal with the proceeds. The question is frequently asked, how much do you feed? That depends upon the size, the constitution or the digestive and assimilating powers of the cow. A cow retains a certain amount of food for her support, the balance goes to you, so the larger the amount of food she can properly use up the greater will be the surplus for you. Use your own judgment, and feed just enough. Use the supplementary dairy arithmetic. If a cow, on ten pounds of hay and five quarts of mixture, would give eight ounces of butter per day, how much would she give on twice that amount of feed? Don't say twice eight ounces, or one pound. That is incorrect. The answer is, one pound, five and one-third ounces.

Where are these cows to be kept? If out on the fields, where I saw so many the other week during the cold spell we've had, I would advise you to plant Norway spruce close together along the northern

and western borders of your fields as wind breaks. But that is not the place for them. No, not in winter, and I begin to think that it is not the place for them even in summer time. I am getting strong confidence in soiling. But, wherever you have them, always have them as comfortabe as possible. In the winter time shelter them from the severe cold. In summer, from the great heat of the mid-day sun, and the ravenous hosts of blood-thirsty flies. I don't believe that dairying can be a success in winter time with any man who has a cold barn. If I were to build a barn on a dairy farm, I would, if possible, face the front between south and southwest; then I would deviate from the old Pennsylvania rule of putting a fore-bay of about five or eight feet to it as far as my cow stables would extend. Then I would want glass windows in front, so as to get plenty of light, heat and sunshine in my cow stables. I would want nature to do some of my butter coloring. Then, right inside of this front wall, I would want an alley so I could get from one stable to the other, and also in the feeding entry without using the outside doors. And instead of having the walls and ceiling covered with dark, dingy, dreary looking cobwebs, I would have it whitewashed. Then you will feel more comfortable in them as well as your cows, and you will probably devote more time and care to them by currying them frequently and keeping them clean. Yes, care, is a great little word in the dairy. When it comes to the products, it is the essence to success. Exercise the greatest care and cleanliness in your dairy products, live up to the truth that cleanliness is next to Godliness. Be not slow to follow new methods and say the old ways are better. Remember that kittens generally open their eyes in about nine days. Don't let it take you that many years to open yours. Have your dairy products look attractive and they will speak for themselves, and you will get the highest price and the greatest reward for your labor.

SOME HINTS ON DAIRYING.

By L. B. ELDER, *West Lebanon, Pa.*

I think it must have been through the mistake of some one that I have been assigned to prepare a paper on the subject announced. It is possibly true in this case, as in another notable instance, where "some one had blundered," that it is "ours not to reason why, ours but to do or die." Under the impression that in filling this part of what seems to be an admirable programme, I am only acting the part of an

usher—opening the door of the subject and preparing the way for the dignitaries to follow. It is but a short time since my attention has been turned, with an active interest. to the dairy business, and it is, therefore, out of but a limited experience that I must write.

It is only the things which we deem of prime importance that can be alluded to in an article like this, and first among these we would mention, as necessary to the best success in the dairy business, that of a well-selected herd. The profitable dairy cow must come up to a fair standard, as to quantity and quality of milk production. You must get after her with a Babcock test and a pair of scales. I should say that the minimum standard should require an average of a gallon of milk at a milking, kept up for ten months of the year, and of such a quality that 100 pounds of it will contain five pounds of butter fat. Had such a cow furnished her milk product to the Elders Ridge creamery for the past year, it would have amounted to 4,200 pounds—would have produced 210 pounds of butter, which, being sold at twenty cents per pound (the average price per pound for the year), would have amounted to $42 for butter alone, aside from the skim-milk, which, at the low rate of one cent a gallon, would be worth over $5, and the calf, as a veal, the balance of $10, making the product of the cow $52 for the year. We mention this as a minimum standard. There are cows of a higher grade at our creamery, and there are others of a lower grade that are bringing some profit to their owners, but which they should aim to replace with better.

As a rule, you need not look for that profitable dairy cow among those sleek and handsome breeds that have a just reputation for beauty of form and a ready facility for turning all their feed to fat. The man who has been accustomed to look with pride on his stately and ponderous "short horns," or to stroke the smooth sides of his "Herefords," whose ribs are hid from sight and almost from sense of touch by a thick blanket of fat, will find it hard to sacrifice these lines of beauty to others of utility, which he is almost compelled to do in his search after the profitable butter cow. In this respect, one cannot be at the same time, on the best of terms with the butcher and the butter maker. When butter is the result to be attained you must take counsel of the dairyman, and accept the cow that stands your test, though she be, in form and appearance, what, at first, you might regard as uncomely and ungainly, and so bony that when you come to milk, you could hang your hat on one haunch bone and the empty pail on the other. In the course of time, you will come to really admire the points that indicate the good milk cow, though they are fiercly at war with the lines of beauty from the standpoint of the butcher. In this case it will be another illustration of "handsome is as handsome does," though she should appear to others as homely as one that Henry Ward Beecher used to own, which he described in

its bony anatomy as closely resembling a "cross between a pair of hoop-skirts and an old-fashioned hair leather trunk."

Our chances of finding our standard cow will be much better if we look among those strains that for centuries have been bred with a regard to rich cream and gilt-edged butter, such as the Jersey and Guernsey and their grades. Look for her here, and remember still to apply your tests, for even among these there are all the varieties—the indifferent in quality and the medium, as well as the good, the better and the best.

Having found the requisite herd, the next consideration is its proper care. One who would be largely successful in this business has much to learn as to the varieties of milk-producing foods—the proper ration of grain or of fodder—how, with suitable variety to maintain a wholesome relish for the daily meals and to gratify it without overfeeding. The theory is that the cow is a machine for the manufacture of milk, and the secret of success is to supply her with the best material and to work her to her highest capacity.

Common sense is a good equipment towards this end—close attention and observation is needed, and sometimes careful study.

But it would be a costly folly for a man to blunder on over what is to him an untried way, and pioneer a course for himself through his individual failures and mistakes, while others have been along this way before, and by their experience made it a highway for others to pass over easily and safely to success. Let every dairyman, if he would take intelligent care of his herd and maintain a proper interest and pride in his pursuit, take some good dairy journal, read it carefully, and discuss it with his neighbors instead of so much factious and partisan politics. If, as the poet says, "we are the heirs of all the ages," the wisdom and experience of the past in the line of dairying is also ours to use and to profit by. Let us welcome, too, occasions like the present that bring us into touch and fellowship with prominent representatives of the State College, where all the time a series of careful and costly experiments are being carried on in this line, to discover methods that may be profitable for our practice.

Cleanliness, too, in the care of the herd, deserves the usual high classification among the virtues. Milk is an article of such easy contamination that it must be relieved as far as possible from the contagion and defilement of evil odors. A properly constructed stall is necessary for the proper cleanliness of a stabled cow. It is next to impossible to keep a cow decently clean on a level floor; the only condition for tidiness is a stall with a platform, raised some six or eight inches above the common level of the stable, and of just sufficient length and width to allow the animal to stand or lie with comfort. A curry-comb, too, is a useful article to keep near at hand. The quiet submission of the cow to its use and the wistful look with which she follows you after you have been scratching her with a vigor

that any horse would resent, is a hint of the plainest kind that it is an operation quite agreeable to her, and that might be profitable to her owner. Out of kindness to the dumb, but grateful brute, we cannot but recommend daily and vigorous grooming. And yet it is likely that the majority of us would wish that friends intending a visit to our herds would give us ample notice, so that we could, for the occasion, bring our theory and practice into closer relationship in this and some other respects.

Much has been said, but not too much, about the scrupulous and consciencious cleanliness required in the care and treatment of milk on its entire journey from the cow to the condition of good, sweet butter. It needs to be repeated, line upon line, here a little and there a little.

In a co-operative creamery, this must needs be insisted upon. In the summer time it is only those who have cool, running water, or a supply of ice, who can keep milk sweet for forty-eight hours. Others less favored, must visit the creamery daily, except on the Sabbath. In the winter season, when milk may be kept for a longer time without thickening, it has been our custom to collect the milk on Mondays, Wednesdays and Fridays. While, in waiting for these times, care must be taken that it is not exposed to anything that would taint it, for it is a surprising absorbent of offensive odors. One household, negligent in this respect, may, by their contribution of tainted milk, infect a whole churning of 200 pounds or more—spoiling its flavor and damaging its keeping qualities. Care in this respect is so manifestly required on the part of all the patrons of a co-operative creamery that their constitution should, and does, reserve the right of investigation into the sanitary and cleanly condition of their several premises, if occasion seems to demand it. Under the old regime, when sometimes the family churning was long in gathering, it might stand around the stove, where the fish were frying, the onions were stewing, and the awful odors of sauer-kraut were reeking from the pot—what if it did hold in recollection a fragrant memory of all these occurrences. The responsibility for it began and ended with the family. They ate the most of it. If there was a surplus, it generally found its way into the hands of the country storekeeper, where, with the loss to him of a few cents per pound, it could end its days as "axle grease." Only comparatively few were injuriously affected beyond those immediately responsible for its unpalatable condition. But in a co-operative system, so many are injured by the thoughtlessness or negligence of others that carelessness must be taken in hand and set outside the association. In this way it is a training of all its members to a higher standard of living and a more thoughtful consideration for the interests of one another.

Those of us who form the Eldersridge Creamery Company, and those who patronize it feel that in another respect we occupy a higher

plane of civilization than we did three years ago, by the relief we have furnished to our wives and daughters from the drudgery of the family dairying, the labor and care of which was then almost exclusively theirs.

Of course, we cheerfully accept their company and help at milking time, and smilingly thank them for a little boost when the eight-gallon can is full, and the boy or the hired man is not at hand. But the drudgery is no longer theirs. The North American Indian, no matter how brawny and powerful his frame, heads the family procession, bearing no other burden than his tobacco, pipe and gun, while after him comes his squaw, bending under the load of the family furniture and the day's catch of game. We, of the creamery, claim that we have left him and his civilization further behind than have our neighbors whose wives and daughters are still left to struggle with churn and butter bowl, and wrestle twice a day with two, and even four-gallon crocks.

We have yet a hint to give to the ladies who still have on the list of their cares the butter-making business. It is that you would suggest to your husbands or fathers that there is a creamery at Eldersridge in active operation, of which you have heard glowing accounts as to the quality of its butter and the relief it affords to overburdened women in that neighborhood; also, that you have heard loud rumors of what they call a skimming station, soon to be erected over here in the neighborhood of South Bend, and that you wish them to take the milk of the dairy to either of these places for one year.

If they should intimate that you might "gad about" or not know how to employ your time, if suddenly relieved of the labor of butter making, tell them that abundant testimony can be furnished from Eldersridge that the women of that neighborhood have still enough left to engage their attention and busy their hands.

When you have secured the compliance of husband or father, as the case may be, by force of womanly appeal or by threat of a strike for higher wages, then dress up in your best, jump into the milk-cart beside him and come along to the creamery and see for yourself the interesting processes through which the milk passes on its journey to sweet and golden butter. Notice particularly the filthy dregs that the separator collects, even from milk kept as pure as ordinary care can keep it, and which would elude any trap that you could set for it at home. One observation of this fact is generally sufficient, but you will likely draw from it at least two conclusions: First, that the proverbial "peck of dirt" which is spoken of as the usual allotment to each individual life, should be enlarged to the full bushel to be fairly consistent with this new discovery, and, second, that we have all narrowly escaped poisoning from the butter that came to the table under the old regime, and when you return home and see how much remains for the busy housewife to do, you will wonder how you used to struggle along under the additional burden of butter making.

WHY DON'T OUR MILK FACTORY RUN DURING THE WINTER?

By E. E. OLMSTEAD, *Corry, Pa.*

We are living in a progressive age. In whatever direction we look, change and innovations meet our gaze. In every department of the industrial world, progress and improvement is the rule. Should the farmers, then, pursue the same old paths, and follow in the same old ruts of years ago, when it was the custom to dry off the cows upon the first appearance of the first severe frost? Judicious breeding has developed cows of such excellence that with the proper care and proper feeding, the flow of milk can be maintained, almost without interruption, throughout the year. Under the old method, cows were left in pasture until their noses and the earth were divorced by a layer of snow, after which they were placed in a stable for nearly twelve hours out of the twenty-four. The stable was well supplied with good-sized cracks for the admission of copious supplies of cold, fresh air, which seemed to have been considered indispensable to health and longevity. The feed, for the first month or two of winter, usually consisted of alternate rations of straw and dried corn fodder, nearly half of which was fed by throwing it on the ground in the field or yard. As soon as daylight appeared the cows were driven from the barn out into the open air, partly with a view of affording opportunity for the large amount of exercise a cow was supposed to require, and partly in order that free contact with the elements might impart vigor to her frame. Her drink was obtained from a hole cut in the ice on the marsh down by the woods. After partaking of the invigorating fluid, upon a zero morning, her vertebral structure described a beautiful arch, while her whole anatomy assumed a graceful vibratory motion in harmony with the undulations of the gentle breeze which fanned her frame.

The whole question of the feasibility of running the factory through the winter months hinges largely upon the possibilities of economic milk production during those months. I think it will be conceded

that if a sufficient amount of milk can be produced to make home manufacture necessary, it will pay to run the factory. For it will certainly pay better to take our milk to the factory in winter than to continually incur the expense of keeping up a full set of dairy utensils, only to be used a little while each winter.

While it is true that farmers have more time in winter than in summer for the manufacture of the dairy products at home, it is also true that the cost of hauling to the factory is merely nominal then, and the exercise afforded the team by a trip to the factory, is often an actual benefit. If, also, we consider the more uniform quality of the product, and the better facilities for marketing, the advantages of the co-operative plan are apparent.

But let us return to milk production. In this, as in all other lines of production, there are certain essentials. Among these are shelter, food, drink, care in handling, regularity in feeding, watering, milking, etc. Without entering upon a general discussion of the proper construction of the building in which our dairy stock is to be kept, we will only say that it should be warm, well lighted and ventilated, and kept as clean as possible.

A little care and forethought in the preparation of food, will result in furnishing the cows with good milk-producing rations, grown almost wholly upon our own farms and at a cost no greater than ordinary timothy hay. The winter rations should consist, largely, of clover hay, millet, sorghum, roots and grain, all of which may be home products. For the proper compounding of rations, allow me to refer you to the reports and bulletins published, from time to time, by our Experiment Stations and Agricultural Colleges, especially the one on the computation of rations for farm animals, which was sent out in November, 1896, from the Pennsylvania State College, and which, I think, may be obtained by addressing State College, Centre county, Penna., with a request for the same.

Pure water, of moderate temperature, should always be of easy access to the cows. If it can be furnished in the stall, so much the better. In no case should the cow be compelled to wade through mud or deep snow to obtain drink, for she returns to her stall with legs and body wet and muddy, so that food, that ought to be utilized in producing milk, is wasted in melting snow and drying the legs.

Regularity in quantity and quality of food, and punctuality in feeding, watering and milking must be observed. With these few hints, and others that experience will suggest, carefully followed, the flow of milk will be almost as copious in winter as in summer, and the factory will become a source of pleasure and profit, both to proprietor and patrons throughout the whole year.

KINDNESS TO ANIMALS.

By Mrs. B .F. Meckel, *Emlenton, Pa.*

The committee has kindly permitted me to select a different subject from the one on the programme. I wish to say a few words on kindness to animals, particularly domestic animals, which add so much to the enjoyment of life on a farm. We do not often stop to think how much they do add, nor how we could increase their happiness. These animals are all very susceptible to kindness. They are such faithful, patient, fond and true friends of man that he should feel it to be a pleasant duty to protect them—to see that they are properly cared for in return for the services they so freely render. It is only within recent times that attention has been drawn to the humane treatment of animals. Previous to that, they were looked upon, by the majority at least, as animate machines, to be used up without mercy and then replaced by others. There were no laws for their protection. Now there are a number, and bands of mercy and humane societies are being multiplied over the entire land. Intelligent study of animal life is doing much to bring comfort and happiness to these humble friends of ours.

In the short time allotted me, I can not give the various methods used, but the foundation of all, is kindness—unfailing, patient kindness. It will pay you many times over to study their habits, find out their wants, and then attend to them properly. There is no other venture in which kindness pays back, in dollars and cents, so rapidly as in the treatment of domestic animals.

The cheese made from the milk of the cows that feed upon the mountain slopes of Switzerland is esteemed the world over. Why is this so? Not alone because the grass upon which they are nourished is so sweet and tender—not alone because they breathe the pure upper air and slake their thirst at the unsullied springs that gush from the crystal glaciers. These things undoubtedly have their influence, but more than these, is the power of the kindness everywhere given them. The mountain maid who cares for them must have a

gentle touch and a sweet voice. The cows come at a call, and the dairy maid who sings is the one they follow most cheerfully. What horses equal those of Arabia? Their fidelity and intelligence are celebrated the world over in song and story. Who has not been thrilled by that chariot race of Ben Hur? Ah, those magnificent Arabian steeds! But it took generations of kindly treated ancestors to make them what they are. Many persons think it foolish and sentimental to be so considerate of animals. They think it indicates a weak nature—a womanish disposition. This is a popular mistake, as investigation proves. Charles Dickens and Walter Scott loved dogs, and all familiar home animals were dear to them. Scott's monument, one of the most beautiful in the world, is on Princes' street, Edinburgh, Scotland, and represents the great writer seated, in his accustomed arm chair, with his favorite dog, Maida, at his feet. What picture of Germany's iron chancellor, Bismarck, would be complete without that of his dogs also? Agassiz, the great naturalist, was one of the kindest men to all animals. He loved them all, and was a firm believer in their immortality. Abraham Lincoln, that noble, brave and generous man, has given us a worthy example to follow in many things, not the least being his care of all animal nature. Many beautiful, tender stories are told of his thoughtful kindness. Daniel Webster, how proud we are of him! That great, handsome, talentd man, before whom all America bowed in admiration, who was loved with an enthusiasm well nigh incredible, had always a loving regard for dumb animals, from the time he plead so earnestly for the captive wood-chuck's life until his own death was fast approaching. Then he bade them carry him from his bed to the window and cause the cattle he loved so well to be driven slowly by, that he might see them all, and, once again, call each by name and say, good bye. Gray Friar's churchyard, in Edinburgh, Scotland, is an historic spot. It was here that the Scots, cutting gashes in their arms, dipped their pens in blood to sign that sacred covenant that is honored by every true Scot throughout the world. Yet there, in that sacred inclosure, stands a monument to a dog. Gray Friar's Bobby, he was called. His master, a poor man, died and was buried in the churchyard. The dog refused to leave his grave and though driven away time after time, he returned to show his love and devotion. The guardian of the yard finally took pity upon him, fed him and permitted him to watch beside the grave of his beloved master. This faithful vigil he kept for ten long years, when, one wintry morning, he was found dead upon the grave. The Baroness Burdett-Coutts caused the monument to be erected to his memory. Kindness to animals is easily learned and easily taught, and it thoroughly and beautifully prepares the way for

kindness to our fellow man. It is one link in the chain that binds this great round earth about the feet of God. It is no unfit accompaniment to that song

"Which came upon a midnight drear,
  That glorious song of old;
From angels bending near the earth,
  To touch their harps of gold.

Peace upon earth, good will to man,
  From Heaven's all gracious King;
The world in solemn stillness lay,
  To hear the angels sing.

For lo, the days are hastening on,
  By prophet bard foretold;
When with the ever-circling years,
  Comes round the age of gold.

When peace shall over all the earth,
  It's ancient splendor fling;
And the whole world send back the song,
  That now the angels sing."

DEHORNING CATTLE.

By W. H. H. Kinzer, *Terre Hill, Pa.*

In regard to dehorning cattle, I will speak from observation and experience. I know that there is a common prejudice against dehorning among many of our people, mostly on the ground of cruelty. But we can never be governed by prejudices; we must be governed by reason if we would succeed in life. The same prejudice existed against every new idea, invention or discovery, all along the lines of the history of human progress.

Had we listened to prejudices, Columbus would never have discovered America. Copernicus could not persuade the wisest sages that the earth moved and that it was round. So strong was the prejudice against this theory that for 1,400 years the wisest philosophers, as well as all the known world, believed that the world was flat and four-cornered, like a State, and they were more convinced in this belief for years afterwards, because the Bible referred to the four corners of the earth.

The first threshing and reaping machines were met with suspicious prejudice. The steam thresher, as well as the steam locomotive on our railroads, were met with much prejudice by our people, and especially our farmers. When fertilizers were first used, they were met with opposition by most of our farmers, and I have known two farmers who lived to be old, and would never allow lime to be used on their land or buildings while they lived. One of them tried a peck on an acre and was convinced that it was of no benefit to the land. So it is all through the history of our development. As farmers, we are naturally prejudiced against every new idea and discovery, until some of our neighbors have experimented and succeeded, and then we, like drones and snails, follow them and forget our prejudices, and do that which is most practical and profitable.

Some say cattle always had horns, and a wise providence placed them there for a wise purpose, and that it is not right to remove them. This seems to be the prevailing opinion of many of our people in this part of the State, and it is a very weak argument to begin with. If this were true, historically, who created the Muley, and the Polled Angus and the Galloway cattle of the country that never had any horns? Why would the male deer have horns and the female deer have none, and why would the male deer shed his horns every year? If providence gave horns to animals for protective use, why have some sheep horns, and the majority of them have none? Cattle, in their original wild state, naturally had large horns and needed them for protection and defense against wild animals, and against one another.

The Rocky Mountain goats and sheep have immense horns, developed to protect them when they slip and fall over the rocks and precipices, and then their horns save them from death in falling. But they are turned inward for protection, instead of outward for defense and goring, like the horns on our cattle. If the cattle, in their large ranges and wild state, needed horns, then it is no more reason that they need them now than that all cattle, hogs, horses and sheep should be left in their original condition, as Providence had provided and placed them in their natural development. The horns are to domesticated cattle, really only a relic of their wild and savage state and are no longer needed. We have no use for the horns for defense, much less to injure other stock or our people. In our lanes, yards and stables, they are a nuisance and an injury to the herd, as well as often the cause of loss of life to our people.

I have read of several people being gored to death this summer. Is it not better that you dehorn your stock than risk the life of your horses, or, probably worse, that of yourself, or your sons or daughters on account of these dangerous horns?

On our own farm, the most reliable horse we had was gored by a vicious animal and had to be killed, and twice have I risked my life

in a savage attack of our horned cattle, and several times the lives of my horses and my family. I have seen and faced more real danger in handling horned cattle, than in traveling 50,000 miles on our railroads.

The next point of gain in dehorning cattle is to prevent cattle from injuring one another. This is the most expensive of all. I have kept an account, and have found that it has cost me on an average about $40 a year to keep the horns on my cattle, and it cost me about twenty-five cents a head to take the horns off.

The strongest cows, and those that have been on the farm the longest time, have a great delight to horn and drive away from the water trough or feed box, the weaker, more nervous or newly purchased cows, and there is nothing cattle so delight in as to horn an innocent, timid one of their own flock when it gets fast anywhere or happens to get into a corner, or when one of the cows happens to get loose in the stable. If there is any such thing as cruelty to animals, our people are guilty of cruelty every time one animal is horned or injured by another, and especially when it results in the loss of life to one of your family. Would you not be almost guilty of murder, instead of cruelty if, by neglecting to dehorn vicious cattle, you would cause the injury or death of any of your family or your neighbors? And yet these things are allowed and happen every month of the year, and who can prevent it or who is to blame?

If a man is injured on a railway, the railway must pay the damage; so, too, if any stranger within your gates is injured by your neglect to dehorn your cattle, you would be held for heavy damages, because you are surely responsible for what you could have prevented.

And here I will prove plainly that the cruelty, as well as the expense of loss by injury is on the other side entirely, and not in the animal that is dehorned.

Where the operation is performed by a practical expert, it is no more painful than pulling teeth, and it his been proven by many herds that the flow of milk after dehorning increased instead of diminished, especially when it is done in the winter season. Besides these ad vantages, it makes a herd of uniform appearance, and is an improvement to a herd to have them dehorned on account of the quiet condition of the cattle, especially when they are in a small space, when feed ing or watering. I can water six at a trough at one time where one took up all the room before. A child of 10 years can tie up cows, where he could not do it at 14 under the old way without danger.

Then, as for fences or fence breaking: Cows without horns cannot open gates or throw down fences, and the dehorned cow will never poke her head through fences and creep like a muley. A muley is a natural sneak along fences, while a dehorned cow is always tender about using her head after she sheds her horns.

I would pay more for a dehorned cow than for a muley on this ac-

count. For breeding cattle, the dehorned, will be much preferable, and, strange to say, there are many farmers who breed only dehorned steers who keep the horns on their cows where the injury to one another is much greater than it ever could be among the steers on account of their peculiar condition. So much for argument; now, how does it appear in practice? I have traveled through the western states and find more hornless cattle than those with horns. I have been among the dairies of Chester, Lancaster and Lebanon counties and find nearly all the cows dehorned. I have conversed with and received the experience of many dairymen and dehorners, and their experience is all in favor of the new method of dehorning. Dr. Hogg, of Little Britain township, this county, has informed me that he was the first to introduce dehorning in that section, and that he had dehorned over 7,000 head of cattle two years ago. Mr. B. Stollfuse, of Cameron township, has dehorned about 1,500. These men are experts, and have done successful and practical work in our county.

It requires an expert to do it with the least possible injury, and in the quickest time. Profuse bleeding will not occur if it is properly done, and the cattle will be nearer alike in appearance and younger looking when dehorned. They will learn to love, instead of hating one another, and the quieter you keep your cows and the more gentle they are handled, the more money they will return to you. Many an excellent butter cow of a nervous disposition is kept in a herd at a loss, on account of the abuse and fear caused by a couple of rough, cross, big-horned cows that seem to think they were placed there to enrich the farmer by the use of their horns, instead of their udders. The dehorning of a few such cattle in a herd sometimes would pay for a good cow in less than a year.

Therefore, I will sum up my points as follows: That it is cruelty to animals to leave them with horns; that it is not necessary to have them for protection on farms or dairies; that it is almost painless to remove them by modern methods; that it is the practical experience of experts, dairymen and cattle raisers that it is a great advantage to dehorn cattle, and that it is much more profitable to keep cattle that are dehorned.

Having had experience with the practical effects and results, I know whereof I speak, and I believe the day is not far distant when a dehorned animal will sell for more money than one with horns, and when the horned cattle will be the exception instead of the rule among our farmers. And I should not be surprised if our lawmakers would so amend our State laws that owners of cattle would be compelled by law to dehorn them on account of cruelty to animals by goring each other and the danger to other kinds of stock and the people who are compelled to take care of them or innocently come in their way, besides making the owners responsible for all damage caused by loss of life or injury from the horns of cattle.

SOME OF THE LATEST FACTS ABOUT TUBERCULOSIS.

By J. MORRIS CARTER, *Chatham, Pa.*

Tuberculosis, or pearl disease of cattle, some of you, doubtless, think of comparatively recent origin, owing to its increased prevalence in our eastern states, and the consequent amount of talk and discussion it has caused; but, in fact, it is a very old disease. In history, we see it described under different names as early as 400 B. C. For more than a century it has been supposed to be contagious, and the meat from diseased animals unfit for food. But not until 1868 was its contagious nature absolutely proved, and not until 1882 was its cause known, when Robt. Koch discovered the tubercule bacillus, a microscopical vegetable organism, many thousand of which could be placed on the head of a pin. It is the growth and development of this little organism which brings about the conditions no doubt many of you have seen, in the lungs, throat and intestines of animals dead of tuberculosis.

All domestic animals are subject to this disease, but in cattle it is the most prevalent. Swine are second in susceptibility to it, then sheep, horses, dogs, cats and fowls in the order named. The exact extent to which the disease exists in our eastern states is very difficult to estimate, as so many cattle are killed which are not examined, and so many diseased which are not recorded.

In Germany, where all cattle are killed in public abattoirs, we find, in the reports from different cities, from five to fifteen per cent. In Belgium and Holland, it exists to a still greater extent. In our own State, it has recently been estimated at from two to five per cent., although by some authorities, much higher. Many herds are free entirely, and in the central part of the State, there is comparatively little. It is around our large cities and towns that it is most frequent, and in some herds as much as seventy-five per cent., and even higher, has been found.

Certain breeds are more disposed to tuberculosis than others, as the Channel Island cattle, the Jerseys and Guernseys; also, the Friessians, which were introduced into our country twenty or thirty years ago. These breeds of cattle, noted for their large butter and milk yield, have been much weakened by the practice of inbreeding and breeding for fine and delicate shapes and qualities. This, together with close housing and high feeding, has made them more predisposed

to all diseases. We would be likely to have the same conditions with any other breeds of cattle if they were inbred, housed closely, and worked as hard as these have been.

The contagious nature of tuberculosis has been clearly proved by many experiments and investigations. There are four principal ways by which it is transmitted from one animal to another: 1st. By a healthy animal breathing the vitiated air full of tubercle bacilli directly into the lungs; 2d. By tuberculous matter being coughed up, either into water or feed trough, and this material taken into the system of a healthy animal, either into the lungs or digestive tract. This is the most frequent mode of infection; 3d. Through the milk from diseased cows. I believe this to be very common, in fact, the most common, way in calves. I have seen several instances where the mothers were healthy, and yet their offspring developed tuberculosis, where it was found afterwards they had been fed on skim-milk from tuberculous cows, sometimes coming from creameries. In experiments, tubercles have been developed in pigs fed on milk from tuberculous cows.

The fourth mode of infection is by heredity, but this is proved to be quite rare; of course, a predisposition may be inherited, and no doubt often is.

The results from tuberculosis which interest us most, are:

1st. The financial loss to our dairymen.

2d. The menace to public health. We have, in Pennsylvania, about 1,000,000 cows. Supposing 5 per cent. to be tuberculous, or 50,000, valued at $25.00 per head, means $1,250,000 worth of tuberculous cows, which may develop, sooner or later, sufficiently to cause death, and during this time may infect as many more. So, merely from the financial loss to our dairymen, it is necessary that something should be done to check the insidious onset of this disease.

Now, as to the second result—the menace to public health. Tuberculosis causes about 14 per cent. of all deaths in the human family, or more than small-pox, diphtheria, scarletina, typhoid fever, typhus fever, yellow fever, cerebro-spinal fever, Asiatic cholera, relapsing fever, leprosy, measles and whooping cough combined—about 110,000 deaths a year in the United States alone from tuberculosis. This great mortality from tuberculosis in the human family has arrested the attention of our scientists and professors of medicines for years. There is no longer any dispute but that consumption, or tuberculosis, in man, and tuberculosis in our domestic animals, are the same thing, and that they are readily communicated from one to the other.

The danger of contracting the disease through the consumption of milk and meat of affected cattle has long been known. The extent of that danger is to-day the principal point of controversy. To show this, we have numerous statistics, experiments and hospital records

showing that tuberculosis is very common in children fed on milk, and nearly always it has been found the milk was from tuberculous cows. Some hospitals give as high as 10 per cent. of children as tuberculous. Experiments in feeding pigs, calves and rabbits on milk and meat from tuberculous patients, have developed the disease in a large percentage of cases.

The question that interests us most now is, at what stage of the disease do the milk and meat of affected cattle become dangerous? It is evident from the results of experiment, that in the earlier stages of the disease, while it exists only in a single organ or to a slight extent, that the meat of such an animal is not dangerous, if carefully slaughtered, so that the diseased parts are carefully removed and not brought into contact with the meat intended for food. It is also evident that when the udder is not affected, the great majority of cases do not give tuberculous milk, though there are exceptions to this rule. But when the udder is affected the milk is exceedingly virulent and infectious. I might say here, that the health of the person consuming the meat and milk from a tuberculous animal changes his susceptibility very much. A person in rugged health is much less susceptible than one who is sick, convalescent or in ill health from any cause, but the latter persons are the very ones likely to be using a milk diet very largely.

In consideration of the facts that tuberculosis is so prevalent in the human family, and that it is identical with the same in our domestic animals, and its highly contagious nature being proved beyond a doubt, from its rapid increase in our dairies, it is evident that something must be done to check, if not exterminate it entirely from our herds.

Some other countries are much ahead of us in this respect, both in time of taking it up and rigidity of inspection. In many places, animals are all killed in public abattoirs and examined, both before and after slaughtering. In cases of general tuberculosis, the whole carcass is destroyed, but when it exists only in one organ to a slight extent, the meat is allowed to be sold. Many of our states have passed laws and appointed cattle commissioners, with the object of checking this disease. Massachusetts was among the first, then New York, Pennsylvania, New Jersey, Illinois, New Hampshire and many others.

Now as to the ways of diagnosing a tuberculous patient: By the physical signs we can only diagnose cases with any certainty in advanced stages, by a general decline in health, together with a short, hacking cough, certain peculiar sounds in the lungs during respiration and certain enlarged glands in the neck, udder, etc. The sounds, during respiration, may be heard when the lungs are affected early in the disease, but by this symptom we cannot diagnose a case positively. We call such cases suspicious, however, and watch them, and

by frequent examinations of a herd a competent man could keep it comparatively free from tuberculosis.

But there is just one perfectly reliable way to diagnose this disease in all cases. That is by means of tuberculin, which is being used now almost entirely, both in this country and in Europe. Its certainty as a diagnostic agent has been amply confirmed. Every animal that has been condemned by the use of it and slaughtered, has been found to be tuberculous. As to the injurious effects from tuberculin on healthy cattle, I believe they are nil, as this has been watched carefully and no authentic case ever reported. The only objection to tuberculin is, that it does not indicate the extent of the disease; in other words, it is claimed to be too delicate a test, and that many cows are destroyed by its use that might live long and useful lives, and never developed into a dangerous form of tuberculosis. This has been true in some cases, but how far are we to read the future and tell which of these incipient cases is going to develop into general tuberculosis, or how soon it may?

Now, is it better to use tuberculin and free our herds entirely from this disease, or only destroy cases as they show themselves to physical diagnosis by general decline in health? I am sure you will agree with me, especially those that have tuberculosis to any extent in their herds, that what we want is to get rid of it entirely, now and forever, if possible, and not have a herd in which tuberculous cases are developing every now and then, not knowing how soon an individual case may appear or even our whole herd may be affected.

At present, in our own State, only herds are being examined upon application of the owner, and when they are examined, all condemned cows must either be quarantined or destroyed by State authorities. A very liberal indemnity is allowed of, as much as $25.00 for grade or common stock and $50.00 for registered stock. Up to the present time, the latest reports give 4,081 cows as having been examined, and 889 condemned. The total appraised value of cows condemned was $21,711.00, making an average of $24.42 per head, or an average of unregistered ones of $21.16, and registered ones of $30.72. Besides the inspection by the State authorities, we have meat inspectors in all large cities, and packing establishments, where all animals are examined before and after slaughtering for all kinds of diseases, tuberculosis included. Now gentlemen, there are two questions present themselves to the dairymen: First, how are we going to keep the disease out of our herds in the first place and, secondly, how are we going to keep from contaminating our herd again after we do get a clean one by means of tuberculin? In the first place, after a herd is cleared of the disease, the stabling and yard should not be used for at least two weeks. In the meantime, they should be thoroughly disinfected and thrown open in every way to the sun to be dried, then whitewashed, using 2 per cent. of carbolic acid in the lime. Then add no

cows to the dairy until they have been examined by tuberculin. This is the only way by which you can, with any certainty, keep your herd free from tuberculosis. It would be very nice if all our dairies could be examined, the diseased cows all destroyed and stables disinfected, and everybody start afresh. But to acquire such an end would entail enormous expense and no end of mistakes, and be very detrimental to the dairy interests. In fact, I think it entirely impracticable. In 1894, Massachusetts adopted most rigid laws in regard to the suppression of tuberculosis. They were going to rid the State in a hurry. They quarantined the State, then appointed nearly 400 inspectors to examine all the cattle in the State, established certain places where cows free from tuberculosis could be procured, then all cows coming into the State had to come by certain points, and be examined and branded free from tuberculosis. This all sounded very big, but it didn't work. It cost so much, created no end of disturbance and an endless amount of mistakes, and was soon abandoned. It was too radical in its measures. Now, the method adopted by our Live Stock Sanitary Board is doing a good deal of work, and, no doubt, some good, but I am afraid it is not leading to anything permanent. As long as our dairymen depend upon keeping their herds up by buying cows from herds that have not been subjected to the tuberculin test and known to be free from the disease, and as long as no more attention is paid to disinfection and general hygienic surroundings, I am afraid a herd freed to-day by tuberculin will soon be contaminated again.

In conclusion, it is my opinion that if the State would appoint competent men to examine all dairies with physical diagnosis three or four times a year, only using tuberculin in suspicious cases, said inspectors to require thorough disinfection and renovation of infected premises, greater attention to cleanliness, improved ventilation and hygienic conditions, it would give better results and do more permanent good, besides being more practical and economical, than the wholesale compulsory use of tuberculin, and the destruction of all animals which react to the test.

EDUCATION FOR COUNTRY CHILDREN.

WHAT IS THE PROPER EDUCATION FOR COUNTRY CHILDREN?

By W. A. WETZEL, A. M. Ph. D., *Penn Argyl, Pa.*

According to Benjamin Franklin, there are three ways by which a nation can acquire wealth. The first way is by war, as the Romans did in plundering their conquered neighbors. But this is robbery. The second is by commerce, which, Franklin says, is general cheating. The third is by agriculture, the only honest way "wherein man receives a real increase of the seed thrown into the ground, in a kind of continuous miracle, wrought by the hand of God in his favor, as a reward for his innocent life and his virtuous industry."

Whether we look at agriculture from the point of view of the number of people employed, or of the value of the product, or of the extent of the foreign trade, it is by far the most important of all our industries. Of the 18,820,950 persons reported by the last census as engaged in some occupation, 7,612,060 were engaged in agriculture. This is almost twice the number engaged in manufuctures and the mechanical pursuits. In 1895, we raised 2,151,139,000 bushels of corn, 467,103,000 bushels of wheat, and 824,444,000 bushels of oats. The combined value of these three cereals for that year was $946,579,600. The total value of all mineral products, mined during that year, was $678,000,734, or about two-thirds of the value of our three chief grains. During the same year, we exported corn for $14,650,767, wheat for $43,805,663, and hog products for $89,696,768. These figures are so stupendous as to be almost beyond our comprehension. Let us suppose that an average car is 37 feet long, and that an average carload is 600 bushels. To hold the corn crop of 1895 would require 3,585,231 cars. This would make a train of cars 25,123 miles long, or long enough to encircle the whole earth, and fill one or two fair-sized switches besides.

But stupendous as these figures are, there is one product of the farm far more valuable than any we have mentioned. Estimate the value of the corn, and potatoes, and wheat, and pork and beef and you could not afford to exchange this one product for all the others put together. I refer to the country boy, not only the future farmer, but the coming

statesman, editor, lawyer and leader of men in all the walks of life. Well may he occupy our minds for a few minutes this evening, for on him depend the civilization, the morality, the advancement of the twentieth century.

"Blessings on thee, little man;
Bare foot boy with cheek of tan!
With thy turned up pantaloons,
And thy merry whistled tunes;
With thy red lip, redder still,
Kissed by strawberries on the hill;
With the sunshine on thy face;
Through thy torn brim's jaunty grace;
From my heart I give thee joy;
I was once a barefoot boy."

What kind of an education should our country children receive? The best is none too good for them. It is often pointed out as a fact, much to be lamented, that many of our boys are not willing to remain on the farm, but seek employment in the great cities. Two causes, the one economic, the other social, impel them to this course. The first fundamental proposition laid down by the economist senior is, that every man desires to gain additional wealth by as little sacrifice as possible. One reason, then, for the emigration of many of our country people to the city is that for them it is easier to make a living in the city than in the country. Then, too, man is a social and religious animal. So long as many of our city churches are more desirable places of worship than the country churches, and the social advantages of the city are so far in advance of those offered by the country, just so long shall we find many country people throwing in their lot with their city brethren. But the fact, I take it, is not to be so much regretted. We have country people enough and to spare. What Pennsylvania needs is not more farmers, but better farmers. Hand work is everywhere giving way to brain work and nowhere more so than on the farm. Machinery displaces the laborer in every department of farm work. On a modern farm, we find grain drills, potato planters and diggers, patent hay forks, threshing machinery, corn planters and huskers and many other labor saving devices. But to run this machinery requires alertness and a high grade of intelligence, such as only good schools can develop.

But what is true of agriculture is just as true of any of the other walks of life. That is, I conceive, that the educational problem insofar as it concerns elementary education, or the education of the child until it is twelve or fourteen years old, is about the same in the country as it is in the city. Statistics show that a large majority of our school children spend only about sixty months within the school room. How may this period be spent most profitably by the child? We must not expect our schools to do too much. They cannot fur-

nish a boy "everything needful for time and eternity." "Children well instructed to thirteen years of age," quotes Dr. Schaeffer, in a recent report, "should go forth to write and speak, to think and to work with open eyes. They may be ignorant of the date of the battle of Cheru Busco, but they can have some bright visions of American statesmanship, and some inspiring recollections of duty sublimely done. They may not know all about physics and chemistry, but they will know something of the laws which govern their lives and the facts which constitute modern progress. They may not know physiology, but they will know a good deal about the conditions of physical health. They may be ignorant of allegro arithmetic, but they will know something of weighing and measuring. They may never have seen a second, third, fourth or fifth reader, but they will read with pleasure, because, with intelligence, the simple prose and poetry of their own country, and possibly will be able to sing songs."

We hear so much at present about the laboratory method of experiment, rather than text book instruction, that we sometimes forget what Dr. Schaeffer calls one of the chief aims of the schools, to teach the right use of books. That man is educated, and only that man is educated who has learned the lesson of self-help. By the right use of books, we can help ourselves to the experience of others, and can make the wisdom of the sages our own. "God be thanked for books!" says Channing; "they are the voices of the distant and the dead, and make us heirs of the spiritual life of past ages. Books are true levelers. They give to all who will faithfuly use them, the society, the spiritual presence, of the best and greatest of our race. No matter how poor I am, no matter though the prosperous of my own time will not enter my obscure dwelling, if the sacred writers will enter and take up their abode under my roof, if Milton will cross my threshold to sing to me of Paradise and Shakespeare to open to me the imaginations and the workings of the human heart, and Franklin to enrich me with his practical wisdom, I shall not pine for want of intellectual companionship, and I may become a cultivated man, though excluded from what is called the best society in the place where I live."

Every district school ought to have a school library, filled with well-chosen selections of literature, history, science and, above all, with the valuable and inexpensive reports issued by the various agricultural departments and experiment stations. Do our children leave the district schools, able to use a library, to carry on an independent investigation of their own, and in pursuing any subject, are they satisfied only with the best that may be known on that subject? If so, they are educated and will succeed whether they become farmers, mechanics or professional men.

So far about the education of children in general. What shall the schools do for our boys as the future farmers, and for our girls as the future farmers' wives? Spencer says that "for direct self-preser-

vation or the main entrance of life and health, the all-important knowledge is science. For that indirect self preservation, which we call gaining a livelihood, the knowledge of greatest value is science. For the due discharge of parental functions, the proper guidance is to be found only in science. For that interpretation of national life, past and present, without which the citizen cannot rightly regulate his conduct, the indispensable key is, science. Alike, for the most perfect production and present enjoyment of art in all its forms, the needful preparation is still science. And for the purpose of discipline, intellectual, moral, religious, the most efficient study is once more, science." But when the district school attempts to teach as separate branches, geology, zoology, entomology and botany, as is sometimes advocated, it has entered a field which may very well be left for a school of a higher grade. There is a great demand at present for books to supplement the regular grade readers. Excellent science readers are published, and may be used in the district schools to good advantage. At least one hour a week should be devoted in every district school to an elementary science branch. A book like Hooker's Child's Book of Nature may be made the basis of such work. Much practical knowledge may also be imparted through the study of geography. Of all the branches in the common school curriculum, geography is the most abused. There is too much of what is called sailor geography. The scholars are made to memorize "all the capes and headlands, bays and harbors, mouths of rivers, islands, sounds and straits, and such other matters as would furnish good themes for sailors' yarns." The word geography means a description of the earth. It places the earth in its proper position in the solar system, explains the movements of the earth, the causes of the four seasons, tells about the air, heat, moisture, cause of dew, winds, rivers, springs, the various forms of life, vegetable and animal. Every child, after a course in geography, should know something about the origin of soil, the effect of heat and moisture on fertility, the effect of climate and soil upon life, the distribution of plants and animals upon the earth. Geography shows us the unity of the human race. Through commerce, we are each dependent on all. "In this geographical view," says Dr. Harris, "the humblest inhabitant may see himself contributing by his day's labor to the world market for the supply of mankind, and himself, in turn, sharing in the aggregate product of all human labor. Its highest lesson is that of the triumph of human mind over the obstacles of nature, and even over the limitations of climate and soil."

We have said that chemistry, botany, geology and zoology cannot be taught as separate branches in the district school. But every child, when he leaves the district school, should have enough chemistry to know that the size of the potato crop depends more on the character of the soil than on the position of the moon at the time of planting;

enough metallurgy to know that a strange cow brought home, is likely to be a little homesick, even if in going to her stall for the first time, she stepped over the ax; enough botany to know that a good healthy bean stalk will entwine about a pole, no matter what the position of the stars at the time of planting, or that flowers need not necessarily be planted in the "jung frau" (virgin) to blossom, or cucumbers in the Zwilling (germini) to bear; enough zoology to know that burying before the stable door, a toad which was allowed to die on a horse's leg, is not likely to cure the spavin; enough meterology to know that the weather is regulated by natural causes entirely independent of the crowing of the rooster. The elements of all these sciences may be taught through geography. This study, then, furnishes the foundation for all future work in the sciences in the township high school, which is surely coming.

We often complain that our district schools are not up to the standard, that the town schools are far in advance of them. I think our district schools are doing excellent work. Probably one reason why the town schools are better than the country schools is because more money is spent on them. You may be interested in hearing the tax rate of the various divisions in Northampton county. The figures I quote are taken from our State Superintendent's report. The school tax rate of the various divisions was as follows:

Townships.	Mills.
Allen,	1.5
East Allen,	1.5
Bethlehem,	1.3
Bushkill,	1.15
Forks,	1.0
Hanover,	1.4
Lehigh,	1.5
Moore,	1.0
Upper Mt. Bethel,	2.0
Lower Mt. Bethel,	2.0
Mt. Bethel, independent,	1.50
Upper Nazareth,	0.6
Lower Nazareth,	0.5
Palmer,	1.8
Plainfield,	3.0
Lower Saucon,	2.0
Washington,	2.0
Williams,	1.2
Average,	1.44

Boroughs.	Mills.
Bangor,	7.0
East Bangor,	6.0
Bath,	3.0
Bethlehem,	6.0
South Bethlehem,	5.5
Chapmans,	5.0
Easton,	6.0
South Easton,	6.0
Freemansburg,	6.0
Glendon,	4.0
Hellertown,	1.5
Nazareth,	3.0
Pen Argyl,	10.0
Portland,	6.0
Average,	5.0

You see that an average tax rate in the townships is 1.5 mills, while in the boroughs it is 5 mills. In 1894, Moore township levied a school tax of 1 mill, which raised a fund of $1,837.98. Moore, in that year, had 15 schools, with an attendance of 489 scholars, term of 7 months; the average salary was $38.50, and her schools cost $6,589.34. During the same year, Pen Argyl had 13 schools, with an attendance of 596 scholars, a term of 9 months; the average salary was $40, and her schools cost for that year, $10,829.81. In Moore township, only 28 per cent. of the money received for school purposes was raised by local taxation. In Pen Argyl, 62 per cent. of the school money was raised by borough taxes.

Suppose that Moore township should raise her school tax from 1 mill to 3 mills. This would raise an additional fund of $3,675.96. The township paid out monthly, for teachers' wages, $577.50. To run the schools three months longer would cost $1,732.50. This leaves a remainder of nearly $2,000. We will now suppose that we have a high school building. In it we will place two high school teachers and pay then $75 per month. This will cost $1,500, which leaves a balance of $500 to buy incidentals for the high school. One of these high school teachers should have the general supervision of the townships schools, so that the work of the different district schools may be systematically carried on, and a careful account kept of all the books and supplies with which the school board must now furnish the schools. Time will not permit us to outline a course of study for such a high school. But put a competent teacher in charge, and the course will take care of itself. A good course, with a poor teacher in charge, is a mockery, while a good teacher will soon correct the faults of a poor course.

What kind of an education, then, should our country child receive? An education that is worth more than one mill on the dollar, an education that is worth working for at least nine months in the year, and no less than nine years in the child's life; an education that makes him think and speak for himself, and fills him with a desire to know the best that may be known; an education that implants in him the desire for good books and the ability to use them; an education that enables him readily to make such calculations as are necessary for the disposal of the farm products; an education that, in the district school shows him the simpler workings of nature and in the high school gives him a more comprehensive course in the sciences; an education, finally, that gives him some conception of his position as a member of the large human family, that implants in him such virtues as make him an honest man, a kindly neighbor, a patriotic citizen and a useful member to society.

SHOULD WE HAVE GRADED SCHOOLS IN THE COUNTRY?

By MRS. REUBEN F. SEIP, *Farmersville, Pa.*

This is a question of more importance than many people suppose it to be. It is a question that needs our careful thought and study. It is one that cannot be settled in an hour, a day, or even a year, but leading educators and learned men have been trying for many years to solve this problem.

It is true that our graded schools in the cities and towns have their disadvantages, but the ungraded schools in the country have far greater disadvantages. Every one who has made a study of school life, or the teaching profession will admit this fact.

We will consider a few advantages of graded over ungraded schools.

1. They economize the work of instruction. It makes the work of instruction earier, and economizes time, as the teacher can instruct a larger class at one time, and, therefore, take more time for one recitation. In an ungraded school, there are so many different grades, which necessitates so many classes, although, in some cases, there may be only one pupil in a class.

2nd. They systematize the work. In a graded school a teacher can proceed in a certain fixed order. He has only one or two grades, and is expected to bring them up to certain requirements, therefore, he

must proceed by a fixed method to do so, in order that his pupils may be ready to enter the next grade.

3d. They improve work. As more time is given for each recitation, the work is thereby improved. The teacher has more time to examine the pupils' work, and make comments upon it. He also has more time to impart instruction, and hear each pupil recite. Here is where the ungraded school is at a great disadvantage. Although a teacher may have only twenty or thirty pupils, he must necessarily have twenty or more recitations, in order to have his pupils graded according to their ability, as near as this can be accomplished, but even then it is a very rare case if a teacher can grade his pupils just as they should be graded, on account of the lack of time. He must make his recitations from ten to fifteen minutes in length, in a few cases twenty minutes, and, therefore, he canot be expected to give much individual instruction in that length of time. A recitation for advanced pupils should not be less than thirty minutes duration, and fifty minutes is not too long. I have visited the primary division in graded schools where the period for recitation was of forty minutes duration, and I heard some of the smallest scholars express their opinion that it was too short. If the time for recitation is so short, the teacher must assign very short lessons, if he wishes to bring out their full value, and then he cannot take enough time to explain all the difficult points, and the mode in which the next lesson should be studied, which is a requisite for a successful recitation.

4th. They promote good order. The fact is doubtless well known to most of you, that where all grades of pupils are mixed together in one room, and especially where the teacher cannot spend much time with them in recitation, they are very likely to be studying up some mischief, and the teacher must interrupt his recitation to correct the offender, thereby using time that should be devoted to the class at hand. The interruption may be ever so short, but it has more influence on the recitation than many people think. In the graded school, where the periods are longer, this is in a large measure avoided, as the pupil's time is more devoted to reciting.

5th. They provide instruction in the higher branches. In ungraded schools it is useless for a teacher to attempt to take up other branches than those that are now being taught, because he has not the time to devote to them, whereas in graded schools the same amount of time can be devoted to higher branches as is given to the intermediate and primary schools, and the teacher makes those branches a specialty, which is a great benefit to the school.

6th. They prompt the ambition of the pupils, by promotion, by keeping up with the grade. If a scholar knows that he will be promoted if he reaches a certain mark, he will, in nearly every case, strive very hard to gain that end. He also wishes to keep up with his grade,

and, therefore, it is an incentive for him to work harder that he may be promoted with the rest of his class.

Upon investigation, we find that the majority of students in graded schools are further advanced than students of the same age in ungraded schools. Of course, there are exceptions to this statement, but the exceptions don't make the rule.

Superintendent W. F. Zimbro, of Franklin county, says: "The more I see and know of the work of our ungraded schools, the more I realize the need for a better system. In too many cases the boys and girls, very often assisted by their parents, who studied only the three R's when they went to school, set themselves up as judges in the matter as to what is best to be taught and learned, and, as a result, too many of them are not studying the branches of the school curriculum as laid down by the law to be pursued in the common schools of our State. This condition of affairs is not to be attributed to negligence, or even lack of tact, on the part of teachers. They, as a rule, are as much dissatisfied with the means at hand for classification as any one. The trouble is the natural incentive to study is too far off. If we can succeed in making this incentive more tangible, we think the difficulty can be overcome. This is one of the evils that the graded system seeks to correct. To be contented with such conditions as they are, without any effort to make them better, makes contentment a vice instead of a virtue. The matter of a graded system has been discussed and re-discussed for years, and our people have come to the conclusion that the time for discussion has ended and that now is the time to act."

Ambitious young people will not be contented to remain on the farm if there is no inducement there to hold them. If they wish to get a good education, they must leave home and go away to school, which is often very hard to do at first, but after they form different acquaintances and see new modes of life which please them better, they become indifferent to their former pleasures and acquaintances, and in some cases stay away altogether.

Many of you are probably not aware of the wonderful influences that are brought to bear on the student while he is attending a strange schools, both by his teacher and his fellow students. Some of those influences tend to lead the student to things higher and better, while others, we are sorry to say, are just the opposite, and if the student has not the will power to resist the evil influences and choose the right, he will fail, and miserably fail, in any useful vocation he may attempt to follow.

I have heard complaints made by people about students that have returned from college, that they were not the same honest, hard-working young men or women that they were before they went. Now, while this is not true in all cases, it is only too true in too many cases, and is due partly, if not wholly, to the influences just referred to.

If this is the case, what is the remedy? The remedy will partly be found, if you give your sons and daughters a chance to obtain a good education at home. Establish the best of schools for them, and keep them there, until they have gone as far as that school can take them. Then, if they desire to go higher, send them to a well-recommended school, and by the experience and knowledge gained in the home schools, they will be able to acquire more knowledge and to influence others, instead of being influenced themselves. If they are well educated at home, they will stand higher in their classes and will complete the course in a shorter time in any school they may wish to attend. But too many young people have no ambition or desire to go higher than our common schools will take them, while others, who may desire to go further, are prevented from doing so on account of the want of the means to pay their way. To both of these classes of young people, the establishment of graded schools will undoubtedly prove beneficial. To the former, it will be an incentive to keep them in school longer, and to gain more knowledge, while the latter will have an opportunity to get a better education, even if they have not the means to go to a higher school.

The township high school system, which was authorized by law at the last session of the Legislature, is the first step that has been made toward the establishment of graded schools in the country. These high schools have already been established in some counties of this State.

In 1895, Lebanon county boasted of two high schools, Butler county two, Chester county four, Montgomery county four. Superintendent J. F. Bigler, of Venango county says: "The township high schools in the county (Dempseytown and Cornplanter) have been centers of education in the townships in which they are situated. The work in these schools has been thorough. Students completing the course in the Cornplanter high school are able to graduate from the normal schools in less than a year.

"With the new law to encourage high schools by a special appropriation, we expect to be able to improve our present ones and establish others in the country. Four other townships have expressed themselves as desirous of establishing a township high school, and there is no reason why these hopes may not be realized. To my mind, no better law has ever been passed in this State toward establishing a higher education than the one referred to above, and I sincerely hope that our people will avail themselves of the opportunities which the 'new order of things' affords."

Governor Hastings, in his message, urges the establishment of high schools in the country. He says: "The lack of higher educational facilities is responsible in a degree for the depopulation of the country districts, inducing parents to send their children away to school, where they form different associations and stay away. The town-

ship school is needed in our agricultural communities to provide equal opportunities and advantages with those now in existence in the towns." In this statement, the Governor expresses the sentiments of all earnest education workers. According to our present system, the people who need education the most and who need the best education, get the least, and have it given to them according to the most inferior plan. Graded schools enable teachers to do real teaching in a certain line of subjects. Ungraded work merely holds them down to school-keepers, frittering away their energies and the pupils' time on a multitude of subjects, unable to do anything well. The country people are the bulwark of the nation, and should have the best.

If, then, we find that graded schools are a lasting benefit in rural districts, the question no longer remains, "Should we have graded schools in the country?" but "how can we best establish graded schools in the country?" You have all heard the old adage—"where there's a will there's a way." So, if we decide that we need graded schools in the country and are going to have them, the way will soon be made clear. It may cost a trifle more, in some cases, to maintain the schools in this way, but the advantages to be derived will be of far more consequence in proportion to the cost. The objection advanced by some people is that if we establish only one school in a township, it will not be sufficient, as some pupils will have too far to walk to school, especially if the township is a large one. The best plan that has yet been formed to obviate this difficulty, and one that is now in force in the State of Massachusetts, is to build the school building on some main road in the center of the township, as near as possible, and then make arrangements with farmers who have teams, to bring in the students in the morning and take them home in the evening. Of course, one man cannot do all this work in one township, but there should be men appointed in different parts of the township to take all the children along his road. He could travel five or six miles and get the children to school in time. And the other teams would be coming at the same time. In the evening, they would be taken home in the same way. This plan, at first thought, would seem to be an expensive one, but if managed properly it is not. The teams would only be on the road about two hours in the morning and the same time in the evening, and in most cases the charges would not be very high, especially during the winter, when his team is not kept very busy. In Massachusetts, it has been found that the schools can be conducted with less expense by this plan than to keep up ungraded schools in the different sections, and at the same time they enjoy a superior system of education.

OUGHT THERE TO BE TOWNSHIP HIGH SCHOOLS?

By S. L. BARR, *West Lebanon, Pa.*

No worthier object can engage the attention of a State than the proper education of the children thereof.

To meet the educational wants of this great State of Pennsylvania, almost an empire in itself, we have established three great factors; first, the common schools; second, the academic and collegiate institutions; third, our professional and technical schools. All these are equally necessary and, although not very closely related externally, their internal relation is intimate. No common school system can be well organized that does not take into view the whole state of learning. The higher education toward which the whole development of mind directs itself, must make itself felt at the very beginning as a plasting, directing power, and all professional schools should rest upon a thorough and full academic course, preceding, to give solid strength and proper self possession to the candidate. All are, indeed, bound together and should not be severed any more than the root from the ascending axis, or that from the ripened fruit.

After having taken into consideration the educational advantages already established in this State of Pennsylvania, would it not further raise the standard of education in our rural districts to have established township high schools?

We had looked forward to the time when pupils would be permitted to graduate from our common schools, and, although it is but a few years since we have reached this crisis, we find in our schools many advantages already derived therefrom. I shall name but a few of its advantages. It is an incentive to regular attendance. A regular course of study having been adopted, the chance is open to every child in the district to reach that stage of progress which shall entitle him to graduation. Most pupils will appreciate the fact that the best work can be done only when they are regular in daily attendance at school.

2d. It has a tendency to systemize the school work. Pupils feel that they have an object to accomplish, and are more anxious to enter school at the beginning of the term.

3d. It causes better teaching. Every competent teacher will, under the new system, strive to compete with his associates. And, last of all, it will lead to the establishment of township high schools.

Pupils who have completed the course of study in our common schools will, in general, have acquired such a love for study, and such a desire for more extended knowledge that they will demand something beyond the common country schools. The result will be the establishment of central high schools in each township where the population is sufficiently dense to justify it, at which the higher course of study may be pursued and completed. Thus so thoroughly fitting the pupils of our rural districts, they may be able to complete a normal or college course in a much less time and at less expense than otherwise directed.

The principal of this high school might act as general superintendent of the other township schools, thus affording a closer supervision of them in their work than is possible under the present system.

INCORPORATING OUR SMALL SCHOOLS INTO LARGE GRADED ONES.

By MRS. R. B. FOX, *Warren, Pa.*

I am well aware that much may be said, both for and against abolishing our small schools and incorporating them into graded ones, but it strikes me that the reasons for are more cogent and forcible than those brought against it. At a meeting of the Patrons of Husbandry at Sugar Run, this subject being under discussion, the decision was given against it, chiefly because the absence of school activities would be a loss to the older members of society, and also of the crowded school rooms that would result from the change. As to the first reason, our common schools were not inaugurated, and are not kept up simply to provide entertainment for and enthuse the seniors in the district; they were institued and are continued for the express benefit of the children, and the question is, in what manner shall they be carried on to be of the greatest profit to them. Many parents, living in out-of-the-way districts, have intuitively felt a lack in these small schools, and, where practicable, have sent their children away, to a larger—perhaps only a district—school, not because of the incompetency of the teachers employed, but for a dearth of stimulating activity, impossible to be had where so few children come together,

Any one who has had the care of children, and especially a teacher, knows that mind action upon mind, a friction of ideas, is productive of keen perceptions; new thoughts and methods of reasoning, an ambition to be equal to, or excel their mates; a friendly rivalry often springing up, where many minds come in contact, all of which are, almost always, conducive to good scholarship. As to the crowded condition of these graded schools, as a matter of course, the same authority that annuls the small schools, will also provide ample accommodations for the pupils in these consolidated schools, the houses being built to furnish room for scholars within a certain radius. One very important item, not to be overlooked, and of much interest to tax-payers, is expense. It is true that, at the first, probably, the expenditure would be increased, inasmuch as the amount realized from the disposal of the discarded buildings, would not provide funds to erect what new ones would be necessary, but believe after the first requisite outlay, that the expenses would be greatly reduced, even after providing transit for the pupils to the central schools. For, in many country districts a school is kept up for four or five pupils; in our own township, there being five schools, with an average of ten or less scholars, the teachers' wages per month aggregating $130, fuel $10.50, making a cost of $2.83 per month for each scholar, without the expense incurred in buying books, repairing houses and other incidentals, while in a graded school, one teacher could easily teach three of these schools, or thirty pupils.

Other, and we may call them minor consideration, are, more children would attend regularly than now. But, you say, we have the compulsory education law; certainly, but I am considering the attendance for a longer period than the law demands, and many would go just for the fun, the companionship on the way; and, while this motive is not praiseworthy nor desirable, yet, as time advanced, they might gain interest in the school and appreciate its advantages. At any rate they would get some good, and some benefit would necessarily accrue therefrom.

Again, many children in the rural districts contract diseases by exposure to severe storms, during a walk of a mile and a half—for many travel that distance—over bleak hills; and, as often as the inclement weather comes on, the children must be kept at home till the storm or cold wave abates, thus depriving them of much knowledge that might be gained by these future citizens. All of these difficulties would be obviated in case of a central school, to which a comfortable conveyance would be provided; and parents need not worry, as I have done, about the children, when small, coming from school through terrible storms, with the "gude man" away, and no one to go for them, just awaiting and watching till the little ones came in sight, and a great thankfulness when they were safely housed with mother.

TEACHING AND ITS RELATION TO FARMING.

By Jesse F. Heilman, *York, Pa.*

Mr. Chairman, Ladies and Gentlemen: Teaching, which stands second only to the ministry, should be entered upon as a calling, like all other professions, dictated by the Divine Teacher through the conscience, and not as a stepping stone for preparing for another position in life. A great many of the teachers of our day enter upon the profession of teaching only as a means of educating themselves, or for securing funds for some other employment, while some merely work for the few dollars and cents it brings into their pockets.

This theme is to deal mostly with schools in rural districts, and, therefore, it must deal with the circumstances of the schools of such districts. No person can make teaching a life work at the salaries that are paid, namely, from $25 to $35 per month. When the State Legislature appropriated $5,000,000 for school purposes, the object was to have better teachers and school advantages, but the school term remained the same, the same class of teachers were employed and in very few instances the taxes were lowered, and, in many cases, worthless school apparatus was added which is good only to catch dust. Dr. Schaeffer, State Superintendent of Public Instruction, says: "There is a form of extravagance of which the taxpayer justly complains. No sooner was our school appropriation raised than the sharks began to scent prey from afar." First came the manakin man, with charts, which sold at a high price so as to permit large profits to sub-agents and sometimes liberal fees to directors' sons for delivering them to the various school houses. Some directors were persuaded to sign contracts which made them individually responsible if they failed to ratify the sale at the next board meeting, or to lift them at the express office. Next came the block man, selling lumber at handsome figures, in the shape of geometrical figures, which the skillful teacher cuts out of paper as far as her need requires in the public school. Finally, came the map man, selling relief maps at $100 a set, which could have been moulded by the teacher at a few cents' expense. The effects of such purchases are soon felt. When a rural district spends thirty to one hundred dollars per school for maps and other apparatus, it makes lower wages, inferior teachers, scarcity of text books and school supplies. "I am well satisfied," says

one superintendent, "that if I had the money that has been spent in the purchase of charts, globes, blocks and other apparatus which is rarely used and which lies in the closet or in some corner under the dust for nine-tenths of the time, I could supply every school under my jurisdiction with an International dictionary, the People's Encyclopedia, a set of good outline maps and have at least ten dollars for each school with which to start a library.". Says another: "Teachers and school officers are beginning to recognize that elaborately constructed charts and complex apparatus will not take the place of a good teacher, and unless used by one who is skillful and thoroughly equipped, such apparatus is absolutely worthless." The purchase of expensive appliances has, in a number of instances, necessitated the reduction of the salaries of the teachers or the shortening of the school term. This is not only a deplorable condition of affairs, but a most reprehensible practice on the part of those who are charged with the mission of expending the money of the people in the interests of the children. Reading charts, outline maps, globes, dictionaries and books of reference are among the essential devices to aid teachers and pupils.

The surroundings of the school room have much to do with the education of the children. The inside of the school room should be adorned with cheerfulness, cleanliness, a warm fire and fresh air. Imitative drawings from nature will also help to beautify, especially when made by the pupils themselves. The school grounds should be adorned with good drainage, pleasant location and different varieties of trees.

A lot of ground unfit for agriculture is in most cases unfit for a school ground, because it will not bring forth the beauties of nature that children will enjoy. In order to create an interest in children and a love for trees and their preservation, the Governor, in compliance with a resolution of the State Legislature, sets apart two days in the year as arbor days, one in the spring, for the purpose of planting trees in the southern tier of counties, and another suited to the more severe climate of the northern counties, and also for schools in the rural districts, where the minimum term does not extend the school into the spring arbor day. On at least one of these days, teachers should plant trees, show children when, where and how trees should be planted, so that the best results may be obtained from them. Children should know the economic value of trees. Scientists claim that four-fifths of the rain falling on a wooded area is held for gradual distribution by springs and freshets, while on a clearing, one-fifth is held for gradual distribution and the other part is carried away by destructive floods. The destruction of forests has, of late years, made the Juniata the mother of floods, while the chief city along its bank is threatened with a water famine. The low-water marks are becoming lower and lower each year, and, because there are less forests to keep the earth cool,

we have less rain. These things can be remedied to a great extent by educating the young in the right direction. Fruit trees are interesting as well as useful, and every child should know that the good Creator strips the trees of their foliage in winter, so that they may be protected from the great strain of the winter winds and snow; also, where the nourishment is held during the winter, that will bring forth the bud and blossom in the springtime, when each tree blooms, what insects disturb different fruit, what spray to use, and how. The child that sees the apple tree bud and blossom and knows no more about it, does not see the beauty of God's creation.

In passing along the streets, how many trees can our children name? Knowing the name does not signify that the child knows all about the tree, but ignorance of the name shows ignorance of all else. If these trees would be studied, observed and discussed, they would have a name, even if it were not a botanical name.

Our ignorance of trees is but an example of our widespread ignorance of nature's works around us. Many of the European schools have little gardens connected with their schools, in which the children are taught how to mix the soil, how to plant the seeds and how to weed the garden and destroy the noxious insects, and how, by the use of fertilizers and skillful tillage, two blades may be made to grow where one grew. All these things should be taught in our public schools. The farmer's son should know that lime is a good vegetable decomposer, and that a heavy growth of grass or weeds, limed and plowed under, will give good results. Secretary Edge says that of the $4,000,000, which the farmers of Pennsylvania annually spend upon fertilizers, $1,000,000 is wasted through ignorance of the simplest principles of agriculture. May we not hope for an era in education in which the rural school will not longer be satisfied with words, sums, problems, figures and answers, an era the boy's mind and eye may be trained to behold the marvels of nature and fully enjoy the beauties of the farm, the forest and the garden, an era in which a man will think it as great a disgrace to be ignorant of the common trees, birds, flowers and insects around him as he now deems it to be ignorant of the letters of the English alphabet or the names of the candidates of his party.

PUBLIC ROADS.

THE ROAD QUESTION.

By Prof. Joseph Dennis, *Bloomsburg, Pa.*

It is a little presumptious, perhaps, for a school teacher to come before a meeting of this sort and talk to farmers on what seems to be a farmer's subject, viewed from a farmer's standpoint. Claiming a farm as my birthplace, however, and being deeply interested in the subject under consideration this afternoon, I trust that, school teacher though I be, I may be able to add a little to the interest and profit of this meeting.

That the matter of good roads is of great importance to the farmer there can be no doubt, but it is likewise to be said that the farmer does not fully appreciate the amount of his interest in this cause. It is, therefore, to be hoped that good roads afternoons may be permanent and prominent features of future institutes.

The subject I have been requested to discuss is "The Value of Good Roads to the Farmer," but I trust you will excuse me if I leave the farmer for a few moments to look at a little history. History has a great many lessons for us, if we will but heed them, and the history I wish to bring to your attention has a good roads lesson in it. That is why I wish to leave the farmer out for the time being.

A great many hundred years ago, far in the east, the Assyrian and Babylonian kings held sway. Many a mighty city and many a fertile province paid tribute to their power. But the Persian empire built no roads. In course of time, its empire fell to pieces, and, to-day, Babylon is but a name.

In later times, the Romans became masters of the world. They, too, ruled many a mighty city and the revenues of many a fertile province filled Rome's treasury to the brim. And Rome built roads. Roads that were built to march the Roman armies out to conquest. Roads that felt the thrill of commerce and bound the Roman world together. Rome's power was great, but still there came a time when her armies marched no more to conquest and her martial arm grew weak. And yet her rule over distant lands was firm, for Roman law and Roman roads did what Roman armies could not do. They held

the Roman government together long years, when Rome itself at heart was dead. The Romans had a way of building things to last, and the roads they built, were built to last. Roman roads are in use to-day in Italy, in France and England, almost without repair or change in eighteen centuries. The Roman roads were object lessons to Europe in later years, and such was their value to people and to state that Europe has built, and is maintaining, the finest roads the world has known. Europe has found that good roads pay. That is the lesson the Romans taught to Europe.

But what about America? Unfortunately for us, the Romans built no roads on this side of the ocean as object lessons for us to copy, and we must struggle by ourselves. What has been our experience? When the towns were small, the farms near by, and trade but illy developed, the need of roads was not so great and the energies of our ancestors were rightly spent in advancing other improvements. To-day, a new order of things is with us. The villages and towns have grown to cities, the nearby farms are sold for city lots and the farms are farther off. The city streets are paved and smooth that the city people may more quickly and easily make use of them. They have but short distances to go, the city blocks are short, but they have learned that pavements pay. Thousands of dollars the cities spend to improve their streets and means of communication, but at the border line of every city and every town these improvements have stopped. The boundary of every farm has been a forbidden threshhold. The farmer uses the same old roads his fathers used. It takes him just as long to get to market, and, since time is money, it costs him just as much. "Traffic between farm and market is costly and uncertain. With scant loans, our farmers struggle through miles of mire, and for weeks at a time, every mud hole is an impassable Slough of Despond." The rest of the world has bent its energies to reducing expenses at every turn, to produce things more cheaply, but, with fathomless miles of mud to travel, the farmer's crops cost just as much to bring to market as they always have. The farmer must reduce his expenses somewhere to be in touch with the rest of the world.

But does the farmer really need good roads? Would he actually gain in cash and save in money if he had a good smooth road to travel every time he went to town? Let us see what use the farmer makes of roads anyway, and how much he hauls to market.

In 1893, according to government statistics, the farmers of our country brought to our railroads 54,000,000 tons of hay. Approximately, 50,000,000 two-horse loads on a fair average as loads of hay go. But in Germany or France, the lands where roads are good, three-horse loads of four to five tons are common, even for long distance hauling. This would bring a two-horse load to about three tons. In three-ton loads, our farmers, on good roads, might have carried the hay of 1893 to the station in less than 20,000,000 loads, or 30,000,000 less than

were actually necessary. Somebody lost the time it took for hauling those 30,000,000 loads. Who was it, the men who bought or the men who sold the hay?

These same statistics show that in 1893, 152,000,000 tons of farm produce of all kinds were brought to market; $500,000,000 were paid for farm implements and machinery to harvest this crop; $1,200,000,000 invested in farm horses and mules to drag it to market. Think of it! Think of being a director in a corporation with that amount of business on hand, with countless millions of paid-up capital invested, and think of doing business in a mortar bed.

Think of waiting for the mud to "dry up;" 16,000,000 horses and mules idle in the stable; $4,000,000 a day for horse feed; $28,000,000 a week. Think of the loss of time and labor; the dwarfed and shrunken values of our farms, of the slack supply and good prices when the roads are impassable; think of the procession of farmers that rush to town and glut the market in the first days of dry weather, and think of the paltry prices they get when everybody is trying to sell to an overstocked merchant. From the standpoint of profit, in dry weather and wet, the badly kept dirt road is much the same. There is little difference between selling a full load at half price and half a load at full price. Another thing—every improvement is a herald of prosperity; every good country road increases the value of every farm that fronts it. Raise the value of real estate on American farms 5 per cent. and you add $650,000,000 to our rural wealth. Put a like increase on the value of farm products, live stock and farm machinery, and you gain $350,000,000 more. Decrease the cost of hauling one year's crop of hay, cereals, potatoes, tobacco and cotton, by only ten cents per ton, and you save $15,000,000. Those are not all the items. They will suffice.

Many of us do not know that bad roads are responsible for so many of our woes, because they have not thought. Some of our farmers are patient and many of them are contented with these roads because they do not know the value of a good one. A good road is a splendid investment. There never was a good road made in any civilized country on earth that didn't pay a large percentage a year on its cost. It raises the value of every acre, invites the farmer to market when prices are good and takes him out of the clutches of the commission pirates who sell his goods behind his back at their own figures, keep their own accounts and pay him a pittance for his toil and trouble. A good road shortens distance, saves time, wagons, horse-flesh, harness, increases the load and lessens the burden, and makes it possible to haul two tons to market with the same power that now leaves one ton stuck in the mire. It brings the farmers closer together, increases their social opportunities and livens up every community it reaches. Imagine a man, knee deep in mud, trying to look cheerful!

"All very good," say you, "but what about the cost of these same

good roads? What about the increased taxes we shall have to pay to build them, and the extra taxes that the promised increase in the value of our farms will surely bring?" These questions are reasonable, and should be answered. As regards the cost and methods of building, I doubt not but that the gentlemen who are with us this afternoon can tell you better and more accurately than I, but I can at least tell you what the experience of the farmers who have good roads has been.

It is pretty generally known that New Jersey has been one of the pioneers in road improvement. Six years ago, an intelligent system was adopted, and it has since been carried on with remarkable success. Some 300 miles of fine roads have been built, at a cost of nearly $1,-500,000, the State paying one-third. And now, Commissioner Budd reports that the fear of increased taxation hitherto entertained by the farmers is rapidly giving way to an intense desire that they shall obtain good roads sooner than the appropriation now made will permit. The commissioner favors increasing the appropriation to $300,000, which would mean an annual expenditure of $1,000,000 for improved roads. As a matter of fact, the petitions of some committees anxious to get the benefit of a share of the State money have been on file for years, and the people interested are naturally growing impatient. Massachusetts, too, is building roads, and not alone for city folks to use, for some of its best efforts are being directed toward the improvement of roads in rural districts. So popular have good roads become in that state that only 15 per cent. of the petitions received for improving roads can be acted on for lack of funds and that, too, with a legislature liberal in its expenditures for this purpose.

It is to be hoped that Pennsylvania will soon wake up to her needs and opportunities and make liberal provision for the improvement of her roads. The farmers who want to get to market in any weather will be able to do so sometime. Till then we must work and wait. "Let us remember that all riches come from the ground; that the food we eat and the clothes we wear are the products of the soil; that agriculture is the great source of wealth, and that no nation ever became great whose farmers were not great. And remembering these things, let us, as sensible, thoughtful people, direct our energies to the work of bringing the city and the country a little closer together. Let us hear no more of the decline of agriculture; let us do justice to all men and all classes, and let it never be said that that man was an American farmer who left, as his last will, a sealed document containing the impressive words: 'I owe much; I have nothing; I give the rest to the poor.' "

OUR PUBLIC ROADS—HOW TO IMPROVE AND MAINTAIN THEM.

. R. LENTY, *Loganville, Pa.*

The question of good roads and how to obtain, as well as to maintain them, is of great importance to every farmer and owner of real estate in this country. This, my friends, is a simple subject, yet there is none, perhaps, that interests and affects so many of our citizens, that is so much neglected and so badly treated, and it is doubtful whether we have any taxation wherein we pay so much and realize so little from the investment, and obtain so little control over its judicious expenditure.

My effort to-day shall be to try to point out the flaws and faults of our present system of road making, and then to suggest a remedy to relieve us from our oppression. I will first, briefly, refer to our road laws, and then to our road customs, and I will try to show you that, while our road laws are not what they should be, they are, perhaps, not so much at fault as our customs.

Few farmers, to-day, would be content or successful in farming, with the same machinery and methods that were used fifty years ago, in the days of the ancient hay-maker and harvester; with such an equipment as the Dutch scythe, the Drumore sickle and the pendant flail, instead of the mower, the binder and the thresher. As regards our roads, and our customs and methods of improving and maintainin them, we have not advanced much beyond the days when our wise physicians treated patients, whose tongues were parched with burning fevers, by giving them all the hot drinks possible, and never a drop of cold water or a particle of ice to bathe their heated brows, or cool their burning tongues. We, in many districts, are dragging through the same old ruts, and in this respect we can claim, with truthfulness, "we tread the same paths our fathers have trod."

A public road is intended for the public benefit, and not to be a public nuisance. It is merely a right of way, by which the public can travel over the lands owned by private parties. This right of way is expected, and intended, to be kept clear of all encumbrances to travel. Beyond the right to travel over this road, the public have no further control or reserved rights. Now, here I propose to show how we get wrong ideas of our roads, and where we suffer by it. While the law grants thirty-three feet for right of way, in places many of our most

traveled roads are only from fifteen to twenty feet wide, and many, that were opened to use fifty years ago still retain the original narrow width, as well as the same old mud puddles in the middle, filled with water for six months of the year, because there is not room enough to drain the surface water to the sides. If the road happens to be wide enough, it is generally constructed with three ditches, one on each side of the road and the other in the middle, with an occasional embankment thrown across to turn the surface water to the side ditches, which, by the way, it seldom does.

Is it not clearly the duty of the supervisor to enforce this part of the road law and increase the width so as to protect the rights of the public who use them, and also that they can be kept in good repair?

The next point of error is in supposing that the road is public property, instead of it being loaned only for public travel. In many places, where people have a large stump, an ugly rock or some other nuisance that is not worth storing, they drag it out somewhere along the road. How often do we see a post pile, a wood pile, a rail pile, a pile of stones or some other rubbish placed and left for years along the roadside, and mostly by the farmers themselves. All of this is calculated to interfere at times with travel, particularly during the night and during snow storms, besides proving dangerous in frightening horses and causing the accidents which follow, resulting frequently in maimed bodies, and loss of life. We must waken up to our duties, and compel others to do theirs, and good results will follow. There should be a line of duty laid down for the supervisors to follow, a series of specifications as to how and when the road should be made, and that at all seasons they must be kept in as good repair as the elements and the seasons will admit. There are some seasons when we cannot avoid bad roads, particularly after a rainy spell or when the frost comes out of the ground in the spring. But, my friends, there is no reasonable excuse for us electing a supervisor in February, who will wait until May or June, when the roads are beaten down level by travel and who will then go over the district with a gang of ten or more men and boys, a team to plow up ditches where none are required or one already exists, and then throw the mud carelessly toward the middle of the road; plow most where it plows easiest, and get over the whole district in about two weeks, carefuly avoiding the hills and rough places, which are left for a more convenient season that never comes at all; open some ditches into fields that are higher than the road, call the work finished and go into a state of torpidity, never to waken up until it is time to collect the tax. I do not think it is necessary for me to say more about our system of road making, as we all have been there. I will, however, give a few suggestions before I close.

We must improve our roads by doing the work on progressive

business principles, with labor-saving machinery and competent men, and by doing the most work where it is most needed and when it is needed. By going over the roads every month and repairing as it is required, and by doing the most expensive work in the season when it can be done to the best advantage, and by making some new pike of stone every year.

There is but one art of road making, and that is to have the middle higher than the sides, and all roads once made on this principle cost but little for repairs for years. Try the experiment of making a single track-way of this material, say a couple of miles a year, until our worst roads are made solid, and we will never regret it. Even if our taxes are higher than before, we will have more for our investment and more speed, comfort and safety, and less wear on our teams in traveling over good roads.

THE ROAD QUESTION.

By J. J. Kaler, *Morgan's Hill, Pa.*

For the last three or four years, the good roads question has been so thoroughly discussed by men of great experience and practical knowledge on the subject, at road conventions, farmers' institutes, township meetings, through argricultural journals, road pamphlets and newspapers generally, that by this time the average reading, observing and thinking citizen should have a pretty fair understanding of the question.

It is admitted by everybody that the country roads in this State, and especially in this section of the State, are not nearly in such condition as they should be, and do not at all compare favorably with the average public roads in many of the counties of our sister state, New Jersey.

Why is this? Cannot the State of Pennsylvania afford to have much better public roads? If not, what are the reasons that prevent it. Governor Black, who has a happy faculty of expressing himself right to the point, in his first message, says:

"The public highways of the State are anything but what they should be. In many instances, rough and neglected, they have called out the most severe, yet just condemnation. Many states," he says, "with a comparatively small percentage of the wealth of New York,

far surpass us in the construction and maintenance of roads. The need for improvement is apparent, and the initial steps cannot be taken too soon, to place our highways in a condition suitable to our wealth and population, and to remove a long-continued and merited reproach."

Now, this is precisely our case in Pennsylvania. The old Keystone State is a grand, wealthy State. We claim that it has more manufacturing establishments, uses more machinery and has more capital invested than any other state in the Union.

That 80 per cent. of the steel produced in the United States is made in Pennsylvania.

That Pennsylvania has the largest locomotive works, the largest ship yards, the largest tanneries, the largest glass works in the United States, and the best Bessemer steel works in the world. That the manufacturing of iron and steel goods, the capital invested is nearly equal to the manufacturing capital of all the rest of the United States. That the mining interest of Pennsylvania is nearly one-half as great as those of all the rest of the states combined, such as coal, iron ore, petroleum, natural gas, slate, cement, limestone, etc.

Now, with all such wealth and unbounded natural resources, the State of Pennsylvania could well afford to appropriate at least a million of dollars annually towards macadamizing and Telfording our public roads.

Most of the road legislation for the last three sessions in this State, I am sorry to say, almost proved a failure. In the session of 1891, the Legislature of this State passed an act for the improvement of public roads, appropriating a million of dollars to be used for that purpose. The basis of distribution, which it proposed, was in proportion to the amount of road tax collected and expended by each township the year before.

Wherever it happened that the people of a township had an unusual high road tax that year, they would have received an unjust proportion of State aid. Besides other constitutional objections, the Governor was obliged to veto the bill. In 1895, the Legislature passed another act empowering the county commissioners to establish and maintain county roads at an expense not exceeding two mills on the dollar, on all real estate and personal property in the county. Under the provisions of this act, the county commissioners proposed to make a certain road a county road. After considerable parleying, the matter was brought before Judge Craig, from Carbon county, who found some technical irregularities in the case, said the act was a new departure, and set the whole proceedings aside.

A few months ago, the commissioners of this county appointed an able and intelligent commission to select some three important sections of road in the county, of a half mile each, to be built under the provisions of this same act, as sample roads and object lessons.

Competent engineers were employed, plans and specifications made, all of which were submitted to the county commissioners. The county commissioners, by a resolution, adopted the report, this being done a few days before the expiration of their term.

The new commissioners, when sworn into office, immediately rescinded the resolution, which, of course, again put a stop to all further proceedings. With nearly all the newspapers in the county opposed to the county road law, I am sorry to say that it looks very much if this act also, prove a failure.

The New Jersey aid law provides that parties desiring to have a road improved, must first determine that the road is not less than one mile in length. The state pays one-third of the total cost of construction, the adjoining property owners one-tenth and the county the balance and maintains the road. If I am informed right, this law has become quite popular in many parts of New Jersey, and several hundred miles of road have already been built under this act.

If ever a State appropriation for the improvement of public roads is made, it may be no easy matter to decide on what basis the distribution shall be made. Should it be on the scale of population or upon area, or upon the number of miles of road in a township, or should each county in the Commonwealth receive its share in proportion to its population, or according to area, or upon the number of miles of road in the county, and the county to build such permanent roads as the proper authorities might order, or use the money to build several hundred miles of permanent roads in five or six mile sections in every county of the State as object lessons.

Should cities and towns receive a share of the State appropriation?

Which of those plans would give the best satisfaction? I have met advocates in favor of every one of those questions. Some of them have probably been not well considered.

In my judgment, the most reasonable one would be in proportion to the number of miles of road in a township. This seems to be the fairest and most equitable distribution.

I have had no opportunity so far to secure a copy of the road bill introduced in the Senate by Senator Brown, but hope the bill will also provide that not one dollar of the money so appropriated shall be used to pay for shoveling mud and dirt in the road, but shall be used only to build permanent roads, such as gravel, macadam and telford roads, and, also, that every township that wishes the benefit of this act must furnish the same amount of money as received from the State, and likewise use it for the same purpose.

The treasury of this State has, for some years, not been very flush. I have heard ex-Governor Pattison, on several occasions, say that it was a hard matter to take money out of the treasury unless it was first put there. Such an annual appropriation of a million dollars, as proposed by Senator Brown's bill, might require a change in our revenue

laws, or a considerable use of the pruning knife by the law-making power, and in the management and administration of State affairs. No one would like to have the appropriations to charitable institutions reduced, for we should all be in sympathy with that unfortunate class of people. No one would like to have the school appropriation reduced, although the money may not be economically applied.

But there are many other appropriations besides those for charitable institutions that might be cut down, and probably less useless offices created. The Legislature of Pennsylvania has been in session not quite four weeks, and quite a number of bills have been read in place asking for the creation of new offices and large appropriations to institutions which never received appropriations before, and it is a question whether they should have State aid.

On the good roads question, the financial question, to my mind, is the first and most important question.

To make this much-needed improvement of our country roads, where are the necessary funds to come from? That's the question. How can the State aid us right along in this cause if it hasn't sufficient funds to spare?

If the State hasn't the funds to spare, should it borrow the money? Give us funds enough without burdening the people, and the good roads problem will be solved much easier. I understand that the entire session this afternoon is to be devoted to the discussion of the road question. I hope all of you will participate in that discussion. Give your opinions freely on the subject. It is your duty to do so. Let us have your opinion, either pro or con. Let all sides be heard, and after all sides are heard, let us hold fast to that which is good.

HOW CAN WE SECURE GOOD ROADS?

J. C. LEASURE, *Cookport, Pa.*

"Good roads" is a question that is agitating the public mind in almost every section. This question is being agitated to such an extent that in all probability there will be some action taken by the Legislature during the the present term with a view to the bettering the condition of the roads. The reason for this agitation is it not to be wondered at.

While it is true, especially in this section of country, that the roads are very much better than they were a few years ago—the corduroy

being a thing of the past—the stumps have been removed from off the surface limits of the road, more care being taken as to road drainage, the roads being kept cleaner of loose stones, plow and the scoop having given way to more improved machinery, thus securing a more even surface, yet there is still room for great improvement. They are not durable enough. They may be put in very good shape during the summer season, but with the recurrence of the fall and spring rains they are found, at times, to be in a condition almost impassable. Amongst the privileged things that we have so much to do with, what we might ask, is more desirable than good roads. There is the pleasure to be derived in the drive, there is the saving in the wear and tear to wagon, to the carriage, to the harness, etc. There is the saving, by reason of the increased amount that may be hauled at a load by reason of having good roads, and the fall and spring is the season of the year that we farmers naturally want to do our hauling. And last, but not least, for humanity's sake, in the care for the dumb animal. If the roads can be bettered, if they are not as durable as they should be, how is the desired result to be attained? thus securing a greater value for the money that we are paying yearly for this improvement. Some say that if the work tax system was done away with, all being compelled to pay their taxes in money, and the supervisors given the power to hire the labor done upon the roads, that we would then secure good roads. They say that the work done would be more efficient. That there would be more labor done for the amount of money expended. We do not think this would bring about the desired result. We believe that the character of the work and the amount of the work done is largely due to the kind of a man that may fill the position of supervisor, whether elected under the present system or under any other system, and that if the supervisors were given the power to hire the labor done, the chances, if the supervisor were disposed to farm the township, at the expense of the taxpayers, would only be increased. The probability is that the cheapest labor would be employed; a class of men would be hired who would not be interested in the roads further than the amount paid them for their day's labor. Who, we might ask, ought to be or is more interested in the roads than the people whose properties are near to or through which the public roads pass. And we might add, that property owners, as a rule, are the most industrious class of people that we have. We conclude, then, that there would be no gain to have a change in the manner of the payment of tax, but would say that in case a measure of this kind were brought about, that there would be an injustice done to property owners, as it would have a tendency to make the burdens of taxation more laborious, for we all know that it is much easier for the great bulk of the taxpayers to pay their taxes in labor than to pay in money. The same arguments would be applicable as against the contracting or letting out to the lowest bidder idea of road making.

How, then, we ask again, can we secure good roads? Roads that will be permanent; roads that will be pleasure to drive upon at almost any season of the year. We will anticipate by saying that we must not expect a thing of this kind to be brought about at once. It is said that Rome was not built in a day; neither will permanent roads be built in a day. But as we have said, we believe their condition ought to be improved. We pay our taxes yearly. In Green township, we pay a tax yearly of over $3,000.00, and while this amount of money is expended judiciously every year by the supervisors under our present system, they do not approach that degree of permanency that they should for the amount expended. We believe, first, then, that there should be some general system of road making established. Different men have different ideas. This year, the supervisors did the work in keeping with their judgment. Next year, we may have a different set of supervisors who may partially undo the work done by this year's supervisors, because that man may think differently as to the road drainage, as to the width and structure or formation of the road bed, as to whether or not they should be built of all clay, or partly of clay and partly of stone, or partly of gravel and so on. If some general system was established and the supervisors compelled to work up to a standard of excellence, we believe a long stride would be taken towards securing good roads. Then, again, we believe that the State should aid in the expense of building and making of roads. For the general public often use the roads more than the people who live along side of them; especially is this true of the main, or leading roads, and in many instances this use is made of by a class of people who, themselves, contribute but very little towards the roads in their respective localities. If the State were to aid, there would be more of a general interest in their maintenance, instead of locally, as under the present system. There would be more money expended, hence, more labor put upon them. There could be more of an even distribution as to the wants of the roads, because some places require more expense, on account of the nature of the ground, than others, for which, under the present system, there is not sufficient tax to meet the wants in the respective locality.

We shall close our paper, then, by saying that with a general system of road building established, together with a closer supervision on the part of the State, the State appropriating its share, through the course of time we would become the possessors of good roads.

THE SCIENCE OF ROAD CONSTRUCTION.

By C. H. RICH, Woolrich, Pa.

The construction of roads. This branch of the subject may be subdivided, inasmuch as different parts of the country have different uses. Some sections, where light driving is done only, they can be constructed cheaper than where a large community is accommodated of varied occupation; again, the quality of the material forming the natural soil over which the road is extended. We will give more particular attention to a general occupation and a varied soil. The first thing considered in the construction of public roads is grade and drainage. After proper grading is done, then the question of construction; can the junctions of earth and stone sections be kept even, so as not to have a jog in passing from one to the other, and can the meeting and passing of teams be provided for. Practical experience has already been sufficient to settle both these points. Roads so constructed show no signs of division between the earth and stone; the passing of teams—no two teams turn out at exactly the same place; hence, we will hold that the wide, hard roads are better served by a narrow one, and the objections to it are removed, while the cost is cut down one-half, and repair one-half. The narrow, hard road, is formed by having the stone in the middle, with a dirt track on each side. Roads of this kind have been constructed for over thirty years, and are in apparently as good condition as when first constructed. In all wet soils, or springy places, there should be an under drain beneath the stone track, with side outlets at places where they are practicable; the space above the drain, tile up to within six inches of the surface can be filled with any cheap coarse material, first covering the tile with straw, to prevent the earth from washing into the joints; field stone, common gravel, sand, etc., may serve for such filling. This should be well rolled and the road finished with a layer of the best broken stone or gravel obtainable, also well rolled; or better still, with two layers of three inches each, rolled separately. When the underlaying soil is naturally porous, the simple construction without a drain is all that is necessary, but the ground under the macadam should be well rolled and compacted, all soft places excavated and filled with good material, but to be positive and sure of success, better drain.

By a sharp eye and a disposition to do the right thing, wonders can be performed. How far, indeed, does our present system compare

with this idea; we elect a man to perform the law who takes his oath of office as bravely as a Spartan, but proves himself to be a Benedict Arnold, or Spaniard. He will carry the water along the road for a mile till a ramping mill race is found, and then have it emptied on an enemy's field at a great expense, when a dozen places much easier secured could have been obtained with half the cost, and without any serious damage, because the streams would not wash. Through so many sub-divisions, the immense waste is thus overcome, and in so doing overcoming one of the greatest nuisances.

In autumn, the storms come, the rains fall; it freezes by night and thaws by day, and the supervisor is like the old woman who put her faith in Providence until the breeching broke, and then, like the supervisor, did not know what to do. Naturally, nothing is done, and the frozen ruts become like corrugated adamant; they strain horses and wreck wagons, until the snow, like a mantle of charity, covers the trouble for a season. Thank God that the inspiration of the Biblical injunction "that a righteous man regardeth the life of his beasts," is being implanted in the minds of men, and public opinion is spreading its wings to carry the impulse of improvement with the wide swath that is characteristic when the period favors its advance; it is dawning upon the farmer that many dangerous highways are limiting these freedoms in commercial, social and progressive life.

The railway men, ever keen witted, see that the inflow to their traffic is hampered more by bad roads than by distance from their stations. Statesmen know that in order to receive recognition, they must march under the caption of public road improvement, or else the knell of their doom will be forever tolled. For county roads, the argument is care, care, constant watching. Rain, frost and a hot summer are busy workers as well as wreckers, and put in long hours. It must be recognized that there is no absolutely permanent roadway, any more than there is ever enduring wagon tire or horseshoes of steel. Belgium blocks, asphalt and macadam are the nearest approach to perfection, and yet they all give evidence that a "stitch in time" will not only save nine, but nine hundred. All will last longer if a caretaker goes out, not only after, but before heavy storms, and prepares culverts and side cuts for the rapid and safe removal of destructive torrents.

A cheap, good road can be thus built. Crushed stone have not only wearing, but arching and locking qualities, and roads can be made of long-enduring character without any extra cost of excavating. They will either arch over soft spots or sink until they do. Hard places are good enough, with a good water shedding cover of stone, and it is far more economical to reinforce sinking sections than to discover them by excavation. It is observed that very few inexperienced laborers can, or will, spread stone if they are dumped in a heap. They will have a center, where rising and falling wheels will soon form two

holes, one on each side. This annoyance, and the slow and costly annoyance of taking a wagon apart to get out the load, would suggest that a wagon for hauling crushed stone be provided that pours the stone in a steady stream directly into one rut, or both, just in front of rear wheels, which have broad tires, and the stone is at once rolled in.

Travelers are unaware that stone has been used, and neither are they called upon to crush stone or pack them with their carriages. This is done when the ruts are wet, and only then. No more stone are applied until other ruts are found, and this may not be until another season. No ruts, and good roads are thus accomplished.

The worst roads can be and are made of crushed stone on hard ground. Put on deeply, they wear without locking and lose the binding grip of their angles. This discourages their use. Ten inches of stone may be put on during five years with little more cost than wasteful repairs; as the work goes on, the ruts will cease forming and be less deep, and, naturally, work conducted with foresight will not be annually lost. This is simple maintenance, with comparative permanence in view. A stone crusher and proper box, the process is very economical. This process gives farmers a commercial value for their hard cobble stones that are now wasted and bleaching in the fence corners, protecting the briar and thorn bush. You say that the average road is good. Of what profit is it to a man to have his team kick up their heels at their load, as they go prancing along over a half mile of good smooth roads, and then plunge into unfathomed depths in a marsh, at a slough or creek bottom? and where is the satisfaction of knowing that there is another fine trotting course ahead, when one is hopelessly "stuck" for the night? so please do not attempt to average the roads. The law of averages does not apply to them, for, practically the road is no better than its poorest places; they are the weak links that measure the chain's strength. Just think for a moment of the last, dark, cold night, when the tug broke and the horse left the shafts, and you were made to get out in the mud six or eight inches deep to fix it up; repair your rubbers pulling from your feet; the horse longing to get home equally with yourself, can scarcely lift his heels in a backward motion; do you remember the cuss words "damn such roads," "to hell with such a supervisor," and your feet getting wet, your patience exhausted, chills creeping over your body; you are then ready to start further on your journey home, but great care prevents you from haste for fear that the temporary fix-up will again cause you trouble. You might as well go for the doctor, as he will have to be sent for. Well you might say that a good road is a good thing when you need it, and that a road is just lovely at times, when, perhaps, you have no use for it, but goes all to pieces when you need it most—that isn't a good road; it is too much like a kicking cow or a balky mule. The road that compels the farmer to haul 50-cent wheat to market before the rain comes, or hold his crop till the

next May, is no road for the farmer. Think of the time you are working in your fields when it is too wet to haul on roads; you had better been sleeping. But the road that will keep good, that will stand heavy hauling during wet seasons, is a good road. With such, we would hear less about glutted markets and freight car famines; prices would not become demoralized, as now.

You may talk of the steam and electricity as "distance annihilated;" so are good roads; it brings the farmer in close touch with the markets of the world; isolated sections would be elbowing the metropolis.

These arteries of the country are going to be looked after, and the old father and the chore boy, the three lads from school, the stags, the rickety wagon with six-inch fence rails; the old plow, stove, heat and road scrapers, this army of incapabilities sent as an advance march of progress, will be a happening of long ago. Before concluding, the actual average distance traveled by teaming horses is a distance of fourteen miles; the difference of time consumed between good and bad roads is 2 hours a day; the net saving per day would be 60 cents; per week, $3.60; per year, of 52 weeks, $187.20; during the time of a single generation of 40 years, $7,488.00; a township of the size of Pine Creek, with 250 voters, a net saving of the stupendous sum of $1,872,000.00. This will more than hold out, if the items in detail were to be calculated on; say that just the interest were expended, this would give you a sum of $102,300.00; bonds issued to this amount, bearing a low rate of interest, payable in 30 or 40 years, would solve the question. Think, for a moment, if wasted time on bad roads were considered, a sum so large and incalculable that a dozen worlds like this could be purchased, including the whole of the planetary system, and after all float a loan on the sum sufficient to darken it forever. "Give us good roads, for we are dying;" "Liberty, and we will live."

BROAD TIRES.

By M. J. SHIMER, *Freemansburg, Pa.*

This subject is one which farmers and wagon users generally think little about, and are very loath to discuss, and usually denounce as impractical as well as expensive. I have found few favorably disposed toward them, and as far as I know no tires of a width of four to six inches are exclusively used in our township (Saucon), except

those we are using on our wagon at our works for the past three or four years.

Our constant use of broad tires for hauling on the public road, mostly to and from the depot, a distance of nearly a quarter of a mile, carrying pig iron, coal and lumber one way and manufactured goods the other, as well as on our farm, and a hilly one at that, that they are by far preferable to narrow ones, for the reason that the public road by them is kept comparatively smooth and free from ruts. If ruts do occur by the use of narrow tired wagons, ours cannot get into them, and thus remains on a smooth track usually made by it. On the farm, on soft ground, it seldom leaves very visable tracks. We would prefer 6-inch wide tires so that we would be able to span all possible ruts that we might meet. As it is, the tires are liable to widen the ruts and requires more time to smooth the road than it would if they were six inches wide. When we have occasion to purchase another wagon, we will try very hard to get 6-inch tires.

There is another very good reason for using broad tires. It is a paying investment, yielding nearly 7 per cent. on the money invested. I do not believe that we have another as good an investment in our business, and I feel quite sure that there is no one here that has made a better investment than can be made by purchasing a wagon with four or six inch wide tires, and every year receiving in cash nearly 7 per cent. on this investment and having exclusive use of the wagon, to say nothing of the incalculable benefit conferred upon the community in the way of road making, and the economy accruing from its use in moving crops and conducting farm service.

You may ask how this is done. Well, let me read to you an act passed by the Legislature of our Commonwealth, entitled the "Harvey wide tire bill," approved June 25, 1895.

Section 1. That all persons who shall own and use only draught wagons on the public highways of this Commonwealth with tires not less than four inches wide for hauling loads of not less than 2,000 pounds weight shall, for each year after the passage of this act, receive a rebate of one-fourth of their assessed highway tax: Provided, however, Such rebates shall not exceed in any one year five days' labor on the highways for road or highway tax, or its equivalent in cash to any one person.

Section 2. "Any person complying with the provisions of section one of this act, who shall make and subscribe to an affidavit that he, she or they has, for the preceding year, owned and used only such wagons with tires not less than four inches in width for hauling loads of not less than 2,000 pounds in weight on the public highways of this Commonwealth, shall be credited by the supervisors of highways of their respective districts in which such tax is levied and assessed, with one-fourth of the road tax assessed and levied on the property of such person. Such credit shall not exceed, in any one year, five days' labor

on the highway for road or highway tax to any one person, or its equivalent in cash, and any supervisor of highways is hereby authorized to administer such oath."

A farmer, like a shrewd business man, should take advantage of every opportunity to make or save a profit; hence, he should comply with the bill and make at least $6.25 a year in a rebate on his taxes by adopting wide road tires. He can practically get his wagon for nothing. I mean, of course, the wagon carrying 2,000 pounds and over. We have in constant use, at our works, a wagon with 4-inch wide tires, costing us $90.00 at the factory, which lasts us about ten years; for this, we get a yearly rebate of $6.25, the price of five days' labor, on the road, on our road tax—we always pay our tax in cash. In ten years, we get $62.50, leaving the cost of our wagon just $27.50, besides we have no expense to repair the roads about our works, which are made of sand and ashes, and the public highway is greatly improved by its use.

The life of such a wagon on the farm is very much greater. We have one that has done farm service for more than thirty years, and is still well preserved. The tax rebate would cover the cost of such a wagon in about twelve and a half years, and for the balance of its life the rebate would be a clear profit, an interest of nearly 7 per cent. on the investment. This is one of the small matters wagon users should look after.

It will not be necessary that new wagons should be bought. It could hardly be expected that farmers and others would abandon the wagons they already have in use and purchase new ones; all that will be necessary will be to have 4-inches wide tires put on their wheels as they now are, even if the felloes are narrow, it will be just as well as if they were wide, although it does not look so well. New felloes, of the proper width, will not be expensive.

The use of broad tires would add greatly to the life of a road, and make better roads than the army of road destroyers that annually claim to work out their road taxes under the plea of road making.

In some foreign countries, notably in France, all wagons are required to use wide tires, varying from three to ten inches. The rear axle, with wheels with 6-inches wide tires is usually fourteen inches longer than the front axle, so that the hind wheels run in a line about an inch outside of the path made by the front wheels; thus, with 6-inch tires, two feet of road width is rolled by every passing wagon. The varied gauge is usually observed with cabs, carriages and light wagons, as well as the wide tires, so that they become road makers instead of rut makers. This would hold good in our country as well, and the saving to our taxpayers would be very great.

The narrow tire rolls smoothly over bad, rutty roads because its narrow pressure levels obstacles of resistance rather than surmount them, while the broad tire, having a wider surface and less leveling

force, surmounts ruts and causes a jolt. This is often used against it, but just in proportion that the roads become leveled and smoothed by the use of the wide tires, the jolt disappears and the ease in drawing heavy loads is increased. With such a system of wheels, even uncoated roads, if kept rounded to the proper shape, some become solid enough to shed the water, and do not become softened by surface water. While, if the surface of the road would be coated with broken stones or good gravel and rolled by passing wagons, it would exclude the water and form such a solid bed that the frost will scarcely affect it.

Were we to adopt a universal use of broad tires, as I have described, it would not be necessary to build such expensive roads, for the thickness of the road material would not need to be nearly so great as would be necessary to resist the almost wedge-like narrow tires of our present system.

The use of narrow tires cannot be too much deprecated, for they are expensive, not only to the owner of them in point of economy, but to the community in which they are used, for, let the roads be ever so well made, they will cut them into ruts, making water ways and pools, so that it will be impossible to keep them dry and firm, this being the most essential element in road construction.

In order that taxes may be reduced, it will be necessary that taxpayers should use every means to preserve the roads when once made, and farmers especially should take a strong hand in this matter.

That broad tired wagons run more easily has frequently been demonstrated by scientific and practical methods. Under certain conditions, broad tires will carry 40 per cent. heavier loads than narrow tires with the same team of horses. A report from Vermont says that "Wide tires are not only lighter in their draft than narrow ones, under nearly all conditions, but they cut up the roads very little; in fact, when six inches wide they tend to make the roads better continually."

Wherever the broad tires have become known and better understood, they have been enthusiastically adopted, and when the merits of the tires, as road makers, become known throughout the country, public spirit will demand their use to become general, and much of the trouble with rough and rutty roads will cease.

Several years ago, during a visit of a few days at Houser's Mills, on the Pocono mountains, in conversation with the proprietor of a large wooden ware manufactory, located there, who at one time, before the introduction of a logging railroad, used eight or ten heavy teams, besides hiring a number of others, to draw logs to his factory, said that when he first introduced broad tires on his wagons, he was ridiculed while persuading his neighbors to join him. He, however, found it useless to change to broad tires while narrow ones were used, since he could not avoid the ruts maintained by them. Neither did he care to roll the roads for others, so he had his axles shortened suf-

ficiently to make the tracks made by his wagons useless for the others; in this way, he had the good road to himself and demonstrated that he could haul heavier loads and retain smoother roads than could otherwise be had. It took but a short time for his neighbors to see the wisdom of using broad tires, and soon, one by one, adopted them, till now, he says, there are few, if any, narrow tires used in that neighborhood. The ground there is soft and sandy, and in many places swampy, yet I saw very good roads where I traveled in the vicinity, all attributable to the use of broad tires.

It would be a philanthropic act to change from narrow to broad tires, and all who feel that taxation is a burden, as all of us do, and would like to see it reduced, should use every means possible to prevent expense. This, then, is one means of doing so. To pray for a reduction of taxes and persist in continuing a system that creates them, is foolishness. Let us consider this matter intelligently and insist on making a change for the better.

COUNTRY HOMES.

HOME DECORATIONS.

By MISS M. EMMA JOHNSON, *Shawnee, Pa.*

Few people appear to possess the happy act of giving a room a cheery, livable look—a look that makes it natural to sit down restfully there and feel at home. Gorgeous rooms there are in plenty; stately, richly furnished apartments that seem to repel rather than invite, and suggest only full dress and stiff conversation. The draperies are in keeping, somber and over-powering, and the pictures are anything but what a poet once called them—"loop-holes of the soul." An atmosphere of coldness and distance pervades the whole; and a sensitive visitor to such arctic regions leaves them with a vivid consciousness of being chilled. This same feeling, however, may be connected with much humbler apartments; places which, with some exercise of taste and common sense, could be made attractive in spite of cramped means. Dark, dismal rooms they often are to begin with, looking out, perhaps, on a dingy street or pathway; and to invest such apartments with anything like cheeriness seems at first a

hopeless task. It is discouraging, certainly, but not hopeless. Sunshine, when it can possibly be had, is the first requisite, and Sydney Smith's idea of "glorifying" a room by throwing the windows wide open to the sunlight has a very plausible sound. But sunshine without restraint is not an unmitigated blessing. It is almost invariably a man's idea of cheerfulness; but a constant glare is quite as dreary as too much shade, and the dismayed housekeeper well knows that it exposes mercilessly all the weak points in her armor. When sunshine is unavoidably absent or scanty, its absence can best be supplied by a glowing fire with the addition of a well diffused light at night. A glow worm of a lamp, that lights merely the table on which it stands, can scarcely be said to "glorify" the room. All flame displays some tint of yellow, and in this fact there is much suggestion for the improvement of dull apartments, as a bright fire or a good light will transform a room without any other aid. Who does not remember the poet's "rude, ill-furnished room" that in the cheery blaze of a wood fire, "burst flower-like into bloom."

In decorating, many a woman appeals to the law of fashion for a justification of her folly and extravagance, as though its dictates were binding upon all and should be considered as irreversible as the decrees of the "Medes and Persians." But all truly intelligent and independent people will spurn the yoke and allow none of its dictates to coerce them into any habits in opposition to good taste, propriety, prudence, economy, or generosity. Go according to the law of means instead of fashion—have in view beauty and comfort and be satisfied. How often do you hear the remark, "Were I to furnish another home, I would not have any room too good to be used." There is much meaning in this declaration. People often expend large sums of money in furnishing and decorating their parlors with costly furniture when articles of a more common description would answer every purpose. After having with considerable difficulty, perhaps, found means for this display, they look upon the gaudy carpets and polished tables "as too good to be used," closed entirely to the light of the day and occupied only by the ingenious spider, who ought to be thankful that he has been supplied with quarters so comfortable and undisturbed in which to weave his "meshy net."

Where the mother has taken a great interest in furnishing and providing enjoyment at home, so as to have it pleasing to the eye and comfortable in all of its forms, everything will be contentment and happiness. All points of neatness about the home are the first practical means of awakening a pleasure in beautiful things and a disgust for the opposite. The different points in the beauty of art and the variety of things in nature that are pleasing to the eye or ear cultivate the aesthetic nature. Much of the happiness of life may consist in the enjoyment of the aesthetic pleasures. Old homes

that have hanging above the firesides and on the walls pictures representing scenes of early childhood, produce a feeling of love and tenderness to the lookeron. We love these old scenes for their sacred associations. Each modern home should contain a library and collections of nature's beauties. The contemplation of nature brings us nearer to all that is beautiful and good, and if our homes are adorned and cheered by nature's charms, it is a perfect bliss to live and act. Nature produces artistic effects. With a free hand she dashes on such colorings as only nature can produce. With an unerring brush does the great artist sweep the heavens with gold, crimson and purple, fused with the living light of the sunset until it fades away into the tender gloom of the starry twilight. In it there is no withholding of color, or reserve of brilliancy and loveliness. Who can rival the equisite delicacy and changefulness of nature's handiwork? Only an episode in the twenty-four hours are sunrise and sunset. Only after it is cut and polished does the jewel shine. A few fleeting summer days mark the life of the butterfly. There are sunless days and rainy days, days of gray clouds and gloom, else sparkle and sunshine, beauty and coloring would not gratify by contrast. Up and out from a back ground of neutral tint glows whatever possesses intrinsic worth and beauty.

Does not the truth of the physical world, like all truths of objective nature, symbolize those of the mental and spiritual worlds? A return to greater simplicity in our habitations, equipage and dress is a return to the order of nature. Excess of color is displeasing. Even two shades of the same color, or at the most two quietly contrasting colors, are better than more than two. It matters not whether the furniture be covered, plain, striped or figured goods,—except the disadvantage in wear of the first,—so long as the coloring is harmonious and the articles comfortable; nor, as I have said before, is it necessary to buy expensive things in order to make a room artistic and attractive.

Frankly furnishing a room with cretonne, because it is inexpensive, has a far better effect than much of the cheap worsted or worsted and silk goods so frequently seen in commonplace rooms. There is no pretension about cretonne; while even the low priced grades are often so artistic in design and soft in coloring that they are much more pleasing than many fabrics higher in the social scale. It gives an air of originality and refinement and is not inharmonious with the odd pieces of old silver, dainty bric-a-brac and choice books. A room may be picturesque and full of comfort at the same time, and it is pleasant even to read of "a bright, chintz-hung bedroom where a fire was burning, and a large snow-white Persian cat was sleeping luxuriously on the white-fur hearth rug." It is a common mistake to suppose that a chintz-covered lounge, or one of cretonne, can be

manufactured at home quite as well as in a place where such work is constantly being done; but a woman with dextrous fingers can buy her lounge "in the muslin," according to the trade vocabulary, and put on its outer robe herself. It should be broad and a sleepy hollow of elasticity; and at least two low armchairs and one large one should be arrayed in the same material. The other chairs may indulge in any amount of variety. Cretonne curtains must be carefully lined with silesia of a suitable color, or with unbleached muslin. If this is neatly done, and they are trimmed on the edges with a narrow fringe, they will hang well and have a good effect. A pretty and inexpensive combination is to use red—turkey red—or blue twilled cotton, according to the predominating color that is to be emphasized or contrasted. Thus the seat of a lounge is divided into four sections with blunt points turned toward the centre, two of the sections being cut from each material. Delicately tinted sateens, with a preponderance of pale blue or green, combine very charmingly with turkey red.

Another foreign, yet simple device, is a great improvement on the cardboard mottoes so much in vogue a number of years ago on the walls of modest residences; and one in a certain pretty room has for its ground work a piece of cretonne well covered with a pattern of roses and ferns. The shape is somewhat oblong, and transversely over the already embroidered surface runs in a graceful curve the appropriate legend, "Lord, keep my memory green."

It is the sweet modesty and the simple decorations that make a home cheerful, not the gaudy and loud. An open fireside opens the weary, dreary life into a realm of beauty. The couch with its luxurious cushions, the pictures, the easy chairs are all delightful, but the key note of cheer and hospitality is struck by the blazing logs or the glowing coals. The worship of things is a passion that carries all before it. Not the fashion devotee to her gowns, the book worm to his folios, or the collector to his stamps or pictures, is so absolutely a slave to his idol as the woman who worships her "things" and is called for politeness sake a "thorough housekeeper." We all know how she lives. She keeps her house, miscalled a home, in spick and span order from front steps to back shed; she shuts out dust and flies, and with them sunlight, fresh air, and all her family. She does allow the latter under stringent restrictions to eat and sleep within the walls, but it is at the cost of nearly every comfort, and in the poorest parts of the house. One whom I knew, kept her nine or ten immaculate rooms breathless and dark, and lived with her four children, winter and summer, in one low room over the kitchen. And the children who grow up under her roof? How are they affected? There may be books, pictures, pretty things and comfortable places to enjoy them in the shut up rooms, but if they know them at all, it is not to benefit them; they are as pleasures peeped at across

a great chasm—something entirely unattainable; their wildest imagination never dreamed of using the treasures or rooms or of making them a part of their lives. Mothers should thoroughly understand that the obejct of pretty rooms and furnishings, of books and pictures, is to give happiness by use and, most important of all, to educate and train the growing and unfolding mind in the knowledge and love of beauty, and the enjoyment of the purer and nobler pleasures of life. Nothing in the world, no education, no wealth no advantage of whatever kind, is more valuable to a human being than a happy childhood. Besides its strong influence in the formation of character, it is through life an anchor that holds against many dangers, and a memory that sweetens many bitternesses; yet how can childhood be happy under the discomforts of slavery to "things." I wish I could picture a furnished home so that you might see as I see—a home furnished where children are taught to handle books and delicate things and encouraged to use them; where "things" need repairing because of hard usage, and where comfort is found everywhere. The result of such a home, now that children have grown to be men and women, is worth a pilgrimage to see. They are not perfect, truly, but they are honest, sensible young men, with respect for women, and genuine womanly young women. As to the house, its furnishings are not immaculate; everything shows that it has been used. But the beauty of the faded pictures and the sweetness of the well-used books have passed into the lives of children and that mother is blessed. We should bear in mind that home decorations are never so completed but that we can add some sweeter charm and thus make it more beautiful. For as the poet has so well said:

"However much there seems to be
In any life of sweetness
And unalloyed felicity,
There still is incompleteness.

When we have reached the goal we seek.
The height of life's inquiring;
We often find the mountain bleak,
To which we've been aspiring.

Where is a song so sweet we're sure
There is not still a sweeter?
Where is a home so good and pure
There is not one completer?

Where is the thought so grand and terse.
So like thought's own Creator;
That somewhere in the universe,
There may not be a greater?

Where is a home so deep and dense,
And black with mortal sorrow;
That it may not find recompense,
Somewhere's in Hope's to-morrow?

These broken and discordant moans,
  Our lives have long out given;
May yet be mellowed till their tones
  Make melodies for heaven.

This life at best can never be,
  With all its fine contriving,
More than a moving tendency;
  A ceaseless upward striving."

THE FARMER'S HOME.

By Miss Jennie M. Boulton.

Somewhere, not long ago, I read a story of a country boy of Oregon, who, tiring of the farm with a boy's love of adventure, ran away and became a sailor, was shipwrecked and grew up to manhood among the Japanese. An officer from a United States vessel, who was ashore at one of their seaports, was assaulted and injured and the commander of the vessel demanded reparation. The Oregon boy was sent for to act as interpreter and in order to ascertain what should be the punishment accorded, it was necessary to ascertain, according to the rules of the country, what rank was held by the injured officer. How many removes was he from the highest authority in his own country? In the order of military rank his place and his superiors' was explained until it reached the admiral of the fleet. Any one above the admiral? Oh, yes; the President. Any one above the President? Unhesitatingly the boy answered, "Yes; the people." And this they could not understand. I sometimes think that only a few Americans grasp that grand truth. Only the few realize that they are really the arbiters of the country's destiny. Let us apply this story to our subject. What makes the nation? The Union, we answer. What the Union? The states. What the states? The counties. What the counties? The townships and boroughs. What the townships, etc.? The farms and homes. Here we are down to the bedrock of the nation—"The Home." Did any of you ever see a happy home where one person tyrannized over all the rest, the wife a slave or the husband hen-pecked? No; such homes are derided or pitied as the case may be, and from them the children escape as from a prison, at the first opportunity. The happy Christian home where father and mother work in sweet accord together for the welfare of

children and each other, where all who enter are made to feel its benign influence, these are the hope of the future—the pledge of the time when nations shall learn war no more, when peace and happiness shall cover the earth as the waters cover the sea. To these homes the heart ever turns for rest; their memory is the last thought of the weary wanderer ere his eye closes on all things mortal. "I go to prepare a place for you, that where I am you may be," is the sweetest word of comfort left by our Redeemer, making us in times of trial and conflict home-sick for heaven. Since the home is the pivot around which revolves a nation's destiny anything that is detrimental to the home is an injury to all; anything that is a benefit to the home is a benefit to all. It is not necessary for me to say to people as intelligent as are the great majority of Venango's population what things are needed to improve and make happy your homes. You know your personal needs better than any one can tell you, but some of us differ as to the enemies and friends of the home, honestly perhaps, widely surely. To me it seems that if the joint counsel of father and mother is beneficial to the home, and all concede that, then the joint counsel is good for the larger home, the country, and the narrow minded solons who inserted the word "male" in the latest Constitution of Pennsylvania, just twenty-two years ago—the good old Quaker founders being more just—and deprived the State of the power to educate and care for its little children unless they were paupers or over six years old, deserve but little honor at the hands of a fair-minded historian. The mothers were not consulted. But, says some prejudiced individual, women should not meddle with politics; it will destroy the sanctity of the home if they do—and of the marriage tie. Does it? Facts, not arguments, are the best educators. The statistics on marriage and divorce laws have brought to the front the wonderful revelation that in Wyoming, where women have voted since 1870, there are fewer divorces in proportion to the population than in any other part of the Union. What does that say; what does it prove? Fewer divorces, more happy homes in proportion to the population. A blind man ought to be able to read that. If you doubt it, get the figures for yourself. They are obtainable.

Oh, yes; says another, but women could not understand financial questions. Well, they are a little fanatical upon the subject of their children; they never could be brought to believe that any sum of money in the shape of license fees could pay for one boy or girl gone to ruin —they really agree with Jesus of Nazareth, that it does not profit to gain the whole world and lose your soul. The truth is they all believe in the doctrines of soul existence. No mother can watch the tiny babe develop into a creature of reason and understanding and believe that this life is all, and so they are less sordid, perchance, in their ideas.

I agree that no woman can understand the wisdom of spending more

than you get for anything. They want bargains—every merchant knows that. A number of years ago I was arguing against license to a high official on the basis of right. Oh, well, Jennie, you don't understand, it is a question of finance, said he, and I went home mystified and vanquished. But I am rather fond of statistics and figures, and since that time I have studied the financial question. I just confess that I can't understand and approve of even Venango county's balance sheet on this subject. Let us see: All judges from the Chief Justice down to the county courts agree that intemperance is the chief cause of crime and pauperism. Yet Venango county, in the year just closed, received as her share of liquor license fees $2,755 and paid to support its paupers $15,921.54 and its criminals $7,480.52, with any amount of court expenses clearly attributable to this cause. Now, try as I will, I cannot see where we are benefited or our revenues increased. The balance gets on the wrong side of the ledger—it costs in hard dollars more than it pays. It takes a strange mind to approve of such business methods and I do not believe any one can explain it to your satisfaction either.

Another objects: but all the women would not vote if they had the privilege. Frederick C. Waite is a statistician for the Agricultural Department of the United States, and he says that at the last Presidential election 610,000 men stayed away from the polls in Pennsylvania alone—other states in like proportion. Now, because they did not vote is not any reason you should not, is it? If some men and some women are too indolent or selfish to give one day to their country's interest, is that any reason those who wish to do so should be prevented? Now, I never feel offended at any poor man when he decries woman and says she is too ignorant, silly, vicious or indolent to be trusted. Every man judges women by those he knows best, and if such are the women of his household, his mother, wife or sisters, he deserves our sympathy and he has mine, poor fellow; I do wish he were more fortunately situated. Now, I cannot understand a system which, in time of peace, can be justified in placing a debt on our country, and that one party in power is just as guilty as the other by the spectacle of a Democratic administration and a Republican Congress now pursuing that course in Washington. I read an address made a few days ago to an assemblage of farmers in Nebraska, made by a man who has been actively engaged in relieving destitution in the city of New York, and who was sent by a charitable society to Europe to study social problems. I wish every one of you could read it. Among other things he said: "The present time is too serious for idle jest. With your bodies bent with years of unrequited toil, your brows wrinkled with the anxious fret of accumulating debts, your hearts aching with the knowledge that after all your self-sacrificing labor your children are to inherit only your cares and trouble. With corruption in high places and self-sold slavery

among the lowly; with iron-handed plutocracy battering into wretched serfdom the children of fathers who gave their patriot lives to make this the land of the free and the home of the brave; with armories increasing faster than schools, with the national debt mortgaging the lives of your sons and daughters, with buying prices fixed by gamblers and selling prices by trusts, with justice defied and law a mockery and charity alone called a crime—it is no time for flippant phrases. God pity the man who is too blind to perceive the gravity of our situation, and save us from the man who is indifferent to our country's peril or allied with our country's foes." Strong language that, but if we think we must agree. It is our country, and whatever injures the country injures also the home. Then pause, think and have courage to stand for "home and country."

"They are slaves who fail to speak,
For the fallen and the weak;
They are slaves who will not choose,
Hatred, scoffing and abuse;
Rather than in silence shrink,
From the truths they needs must think;
They are slaves who dare not be,
In the right with two or three."

THE CARE OF THE SICK.

By MISS MARY HOPKINSON, *Landisburg, Pa.*

It is impossible to prepare rules or methods for taking care of the sick that can be used at all times, in all places and by every person, for the difference in temperament and the surrounding of the patient often requires a different course of treatment for the same diseases. For instance a nervous, excitable person cannot endure the sound of turning the leaves of a book or the rustling of a newspaper, and even the swaying of window draperies is often very annoying to them. So that everything that is irritative to their nervous system must be carefully avoided. To the patient with strong nerves, the silence is just as irksome; they like to hear the family moving about and to have some idea that affairs are moving along as usual.

A couple of years ago a strong man was stricken down with disease: his family went in and out of his room on tip-toe for fear of disturbing him. A neighbor called to see him and walked into the room with

a firm step. The sick man opened his eyes, looked at his neighbor and in a weak voice said: "My boots are standing 'round some place; bring them here and put them on the bed beside me." "Why," said the man, "what do you want them for? You cannot put them on." "No;" said the sick man, "I intend to throw them at the head of the first person who comes sneaking into this room; it just provokes me at them." The friend suggested "that it would be better to get some old shoes, as they would not be so heavy to handle while he was so weak."

Often the room that the patients are in, is so situated that it is difficult for the one who is taking care of them to give to them all the attention and careful treatment they are anxious to bestow upon them.

If it were possible to do so, the sick should be placed in the most pleasant room in the house. I regret to say that this is not always convenient for the family to do, for often the busy mother must take care of her sick while doing the work for the entire household, losing her rest at night and not a minute to sit down during the day except while she is eating her meals. Under such circumstances she must manage the best she can by having her sick ones where she can with the least loss of time attend to them. Not that she cares for the time she is giving to them, but there are so many other things for her to do, that she cannot give to them all the attention she is longing to bestow upon them. And if a case proves fatal the remainder of her life is filled with regret that she was not able to devote more of her time to caring for her sick one.

One of the first essentials of the room of the sick is cleanliness, for if "cleanliness is next to godliness" on the bed of the sick is the place to have it. If the bed linen—or cotton, whichever it may be—and the patient's clothing are not frequently changed, the patient is annoyed by a feeling of uneasiness that they cannot explain. At such times if they are given a bath and their clothing changed they at once feel a sense of relief. By giving them a bath, I do not mean to place them in a bath tub. But take a wash bowl of very warm water, with a spoonful of ammonia in it, and a piece of soft flannel. Wring the flannel very dry and go softly over face, neck, hands and arms, drying carefully with a soft warm towel. Continue wringing the flannel and bathing in this way until the entire body has been bathed. Then change the clothing for fresh, clean ones that have been well aired by a warm stove, and be careful to keep a warm blanket over your patient while bathing that there may be no danger of taking a chill or cold from it. They nearly always enjoy a refreshing sleep after such a bath. In my experience with the sick, I have always found it to be soothing to them to frequently bathe hands, face and neck when too weak to enjoy a thorough bath.

The next thing to do is to have as much pure air as is possible in

the room, and this I have always found to be one of the most difficult objects to attain. That is, to have a current of fresh air enter the room in such a way that the heavy fever laden air may be driven out of the room by it without making a draft over the patient. But the air must be changed even if it has to come through another room or hall to reach the room where the sick are.

By all means let in the sunshine. Shade the eyes, but do not shut the sunshine out of the rooms of the sick, for there is nothing more depressing to the spirits than gloomy rooms, nor is there anything more invigorating than pure air and sunshine, and this is especially so with children.

The next is, when a physician is employed, give all medicines according to his orders and instructions unless such orders are given while under the influence of strong drink. Then the nurse must use his or her own good judgment, for, as some one has said, "a nurse can often take the place of the doctor, but the doctor cannot take the place of the nurse." For this reason the nurse should be very observant, noticing every change in feature or expression or temperature, that when the physician makes his calls she can give him an intelligent account of the patient's condition during his absence, or from the time he makes one call until the next one is made. For no one but a physician can know how exasperating the neglect of attention to these things is. Often they are not informed of the change in a patient's condition until too late to give relief. Often, too, the patient's life has been cut short by the neglect of the care takers to give them their medicine at the time and in the way it was prescribed.

I remember once, when scarlet fever was making one of its usual visitations to our community, the case of a six-year-old child in the first stage of the fever. The doctor was called and asked what he thought of its condition. He gave them some powders for him, saying that with care he would be all right in a couple of days, but added, "Do not give him any pie to eat."

Father and mother coaxed and tried to bribe that boy to take those powders, but no, he would not take them. At last the father just threw them out of the back window, saying "that he would do just as well without them." I told them before 12 o'clock that night they would go and hunt them up again. The boy said "Now, mom, I want a piece of raspberry pie." He got the pie, and at four o'clock that evening the doctor was again sent for and was puzzling his brains to understand how, after the condition the child was in in the morning it was so much worse after taking, as he supposed, the medicine he had left for him. He did not know that the powders had gone out of the window in place of into the child's stomach, and for days afterwards the child's life was in danger because the doctor's orders were disobeyed.

The next thing to be carefully considered is the diet. Only those who have had the care of the sick know how hard it is to prepare something to tempt their weakened appetite. There are patients who are constantly craving for something to eat, and nearly always for articles of food that are not for them to have. Others again will turn wearily away from all that is placed before them. For this reason their diet should be varied. Do not take to them toast and tea for meal after meal, or cream soup in the same way, until they detest ir forever after. But each day try to think of some little change to make in their meals. It is better not to tell them what you are going to give them to eat until you place it before them in as tempting a way as possible, for often it is not so much what they get as the way they get it. Occasionally consult them as to what they would like to have; then, if it is possible, let them have their choice of food. Take it to them in as nice a way as you can. Many persons do not think it needful to prepare a meal for the sick, but if there is a time in our lives that we can appreciate a dainty looking meal, it is when we are sick. A half cold, half cooked, ill prepared meal will not tempt a sick person to take enough of it to build up strength. And the diet is one of the needful things to help to bring back health to the sick and weak.

I can now recall an incident that occurred a few years ago. An aged woman had been sick for some weeks. I called one evening to see her. She was pillowed up in bed and had a hard, dry piece of toast in one hand, while with the other hand she steadied a cup of cold water on the bed. She would nibble off a little of the toast, take a sip of water to wash it down. I looked on for a few minutes, then I said, "do you not like soft toast?" She answered me, "the doctor said I must eat just water and toast." I said, "give me this water and toast, and let me make you comfortable in bed until I come back. I went to the kitchen, there I found a good fire. I asked if I could make something for the mother to eat? They were very kind and said, "yes, anything I wanted they would get for me." I put a tinful of fresh water on the stove. I then asked for a slice of bread, fresh cut from the loaf. It was given to me. I asked for a nice white plate and if they had a china cup and saucer. They said, "yes, mother had a nice one given to her on her birthday." I told them to put a half teaspoonful of cream in the cup and a little sugar. I browned the bread at the coals, poured half the boiling water into the cup, dipped my piece of toast into the remainder of the water to soften it, put it on the plate, sprinkled a little salt on it, put a teaspoonful of jelly on the plate. With a board covered with a clean white towel in place of a waiter we carried her little supper in, raised her up in bed, and to the surprise of all she ate all the bread and drank the cup of contentment, saying "that she never knew before that hot water was so

good. The doctor intended her to have water-toast, not water and toast.

We could write of many ways of caring for the sick, but after all is said, it is only by close observation and by being in sympathy with the sick ones that we can give them the care that each particular case requires, and succeed in drawing their minds off of themselves onto something else that will interest them, for the condition of the mind has a very strong influence over the body, and for that reason cheerfulness is an indispensable element in the presence of the sick. However sad we may feel, we should try always to speak in a hopeful and encouraging way to them. Do not relate to them all the harrowing news of the community, and do not whisper it to some one in the room, and thus give rise to curiosity and suspense that may be injurious to them, but try to keep them as quiet and calm as possible.

A MODEL COUNTRY HOME.

By IDA LEDEBUR, *Starr, Pa.*

A country home can be made cozy, comfortable and convenient without being elaborate. We need not go beyond our means in constructing such a home; it may be very economically built, and yet be a model in its way. The mother is the leading spirit in the house. On her devolves the great responsibility of making the home what it should be. She looks after all the innumerable household duties pertaining to a well regulated country home; also after the welfare of the boys and girls, and it is her moral and spiritual influence that directs, guides and controls to a great extent the future welfare of the family. She is the nucleus around which gravitates the happiness and sociability of the children; through her kindness and gentle influences also the husband is drawn into closer touch with the family circle, and a mutual sympathy pervades the whole family.

Don't shut out amusements from your home, but let the young folks enjoy themselves. Leave in the sunlight; it is health-giving and invigorating, inducive to cheerfulness and contentment.

Furnish good literature in your home, not forgetting a good agricultural paper. Why do not some of our young men avail themselves of a course of home reading in agriculture, offered free by our State college. and study up technical agriculture and horticultural subjects?

It is a farmer's privilege as well as duty to make everything in his home as handy as possible. A pump should be in the sink in the kitchen; fuel close by the house so the boys can in a few minutes carry in enough for the day; an elevator from the kitchen to the cellar. A farmer with a little ingenuity can put this in himself and it will save many a weary step for the frequently overworked wife.

Now, I do not wish to convey the idea that the farmer is a man of leisure with very little work to do and nothing to trouble his mind, the wife doing all the work. Not at all. He has an unlimited supply of physical labor, and if he is energetic and progressive he will find sufficient brain exercise to keep that organ in a good working condition. Nevertheless, it is true that a great deal depends upon the mother to make the home and surroundings neat and attractive. She wants fragrant roses and a few climbing vines about the house, clean walks and a well kept lawn, with shrubbery and a few evergreens and flowers to beautify the surroundings. The influence of our surroundings tends to wear off all the rough corners of country life, and as we learn to admire nature in all its beauty, we will then be contented and happy.

HOME DECORATION AND ALL THAT RELATES TO COMFORT, CONVENIENCE, HEALTH AND ENJOYMENT IN A COUNTRY HOME.

By GERTRUDE MCELHOES MORROW, *Tionesta, Pa.*

The words of the old saw—

"My son is my son till he gets him a wife,
But my daughter's my daughter to the end of her life,'"

have been running through my mind ever since I consented to write a paper for this institute, and in them I found the only reason why I should have been selected to write, for a farmer's daughter I am and shall be "to the end of my life."

One cannot long live in a home in either town or country without becoming keenly alive to its comforts and discomforts, its beauties or its lack of beauty. Where is to be found a farmer's wife or daughter who is not ever on the alert to discover some new way to disguise some ugly, stubborn fact of every day life? A mistake in the location or plan of the house, or maybe only a mistake in the color of paper or carpet, seeking ever to find out the tones which will har-

monize with the notes already struck till all is "one grand, sweet song."

The things I have seen may not be new sights to many eyes but they may be to some, and may open some eyes to see the heaven that lies around us at home—our country homes.

First, let us view our home from the outside, remembering other homes that nestle among vines and branches. Think of the robin's nest built up of bits of sticks and grass, yet so carefully set among the branches as to seem quite in place after all; the big, gray hornets' nest, a part of the limb from which it swings, and the oriole's nest, a piece of nature's own drapery on a favorite tree. Seeing these we will not set our house out by itself in an open field, but will leave some sturdy monarchs of the wood to guard our homes as he has guarded the homes of birds and squirrels in years gone by. Of course, no tree should be left so near the house as to endanger its safety in a time of storm, but yet near enough that its protecting shadow may fall upon us daily.

But if our home is already built and the woodmen have not spared a single tree, what may we do to get into harmony with our surroundings? Other trees may be planted, and while they are growing into shade givers we may plant vines to cover our porches and windows to catch the feverish fingers of sunlight, ere they penetrate too deeply into the life centres of our home. It is well to plant two varieties at first, an annual that will clamber clear to the roof in a single season, and the other a slow grower that will at first only reach a little ways upward, but year by year mounting higher clinging to brick or board, wherever it can find a foothold, till the annual need no longer be planted. Are vines healthful? I think so. Of course we do not want them to screen our windows; but in slender columns to sway back and forth with every passing breeze, not excluding the sunlight entirely but extracting from it its fiercest glare ere it reaches our rooms. It is now asserted that vines, instead of inducing dampness as is sometimes urged, really absorbs moisture in their close contact with moist surfaces.

But vines can never take the place of trees, so what shall we plant in our yard? Apple, peach, pear and cherry trees. Fruit trees! Yes; but not because they are fruit trees, but because they are truly decorative. What other trees present such a variety of attractions as those I've named? Take the apple tree, a mass of daintiest pink and white blossoms in May, and a mound of pale green, changing to a deeper shade as the season advances till, in September, the rich hues of the ripe fruit shine out from a background of rich dark green. What sweeter scent that than afforded by these blossoms?

> "Blow, wind, and waft thro' all our rooms
> The fragrance of the cherry blooms!"

Let sombre yews and spruces find a place elsewhere; there is no room for them about the farm house door.

But we must hasten; we are only in the yard; let us mount the steps and stand on the porch—not the veranda or portico, please, just a porch—a good, big wide one. Let it be big enough to accommodate the whole family on summer evenings, without having to hold an overflow meeting on the steps and grass below.

Let us visit the living room first; the brightest, cheeriest room in the whole house. The room which exerts on every member of the household an influence either uplifting or depressing. In the winter season this room is hung with paper of some warm tint, perhaps of yellow, since it catches and makes much of every chance sunbeam and helps light up the room on gloomy days. Yellow, the color of sunshine and ripened grain, is always a cheerful color, and, when skillfully used, never a trying one.

There is plenty of light in our living room; the vines have been taken down and the winter sunshine enters unrestrained. A few thrifty, hardy house plants brighten one window; not many, for farm housewives are busy folk, but they are sufficient to bring to our minds through the long dreary winter the green and the bloom of a summer to come. Above them in his cage a bird flits about singing, now and again, of brighter days and summer skies.

Pictures are on the walls of this room, not expensive ones, perhaps, but pictures which mean something. A restful landscape, maybe, for one; the pictured face of a saint or cherub for the second, and some historical scene for the third. Choose this latter carefully, for children ask often for stories and many a good story is suggested by pictures. Let no unworthy picture find space on the walls of this room; a really poor picture is dear at any price.

If we have only a few pictures, let us change them around so that we are led to look often at a favorite picture because of its new environment. Let the etching from the parlor change places with some more familiar one in the living room and each will be restudied by all.

The furniture in this room is bought for use rather than as ornamental features. There is a wide, low couch where weary mothers may snatch a few minutes needed rest at times. The couch has lots of pillows with bright, strong washable covers. They are not too fine to pillow the roughest boyish head, and strong enough to endure an occasional pillow fight. The cushions and head rests on the rockers and easy chairs are all on "to stay," for father and the boys (as a rule) do not like to pick up things. There is a big, flat floor cushion (I hope it has a red cover) which delights the heart of the child who likes to lie on the floor and read his future in the glowing fire or in summer to see the moon rise from his couch—the porch—made less hard by his faithful floor cushion. There is not much

that is merely ornamental in our living room but much "which pertains to the health, comforts and convenience of our country home."

Let us visit the parlor. Have you ever seen a parlor like this? The door creaks a little as we enter, showing that it is seldom opened. The couch springs are as stiff as when set here years ago. The chairs are so unused looking that we dread getting acquainted with them; the curtains hang firmly; the family portraits frown at us from the walls, and our conversation languishes and we long to be back in the free and easy living room. No amount of cost and labor will impart to our rooms the charm which belongs to rooms in which every day human lives are lived. So let us open wide our parlor windows in summer to let the winds blow the primness out of the curtains, even if it should bear with it some unwanted dust. Let us all gather here for music on summer evenings and Sabbath afternoons. Let us have fire in the parlor sometimes in winter when no company is expected and spend an occasional evening here just by ourselves. For some of us will use these homes of ours only a little longer till we hear the call to "the upper country, the fairer day," and let us enjoy to the full the best we have—all by ourselves—occasionally, for "we love our own the best."

In this room the clever fingers of the girls find expression in embroidery, drawn work, etc., for table covers, draperies, photograph holders and dainty sofa pillows. Care should be taken in work of this kind that each piece harmonize with every other. Many a bit of really beautiful fancy work loses its charm by being placed among incongenial neighbors. Who has never seen a pink headrest on a red chair? Parlor decorations sometimes assume curious forms. Gilded clothes pins and toasting racks may be decorative, but I must confess my inability to view them in that light. In faraway city homes a decorated spinning wheel may serve to show how the "world do move," but in our country homes where the busy whir of the wheel has scarce died away, it is quite too soon to attire it in paint and ribbons and use it as a decorative possibility. Wouldn't it be quite as good taste to treat the discarded scythe and rake to a coat of paint and a ribbon or two? Where would the end of these things be? "Dinner is served."

Few farm houses can boast a dining room and especially in winter, the most of us like Mrs. Whitney's girls must either "dine in the kitchen or kitch in the dining room." So into the kitchen we go to dine. The table linen, though not very fine, is white and clean, the clever fingers of the girls have wrought a centre piece and doilies. In winter we must do without floral table decorations, but all summer long flowers may be had for this purpose. If we have no time to cultivate flowers, the children can find some very effective wild ones. A centrepiece of daisies and wild roses is within reach of us all in their season. One of the prettiest centrepieces I ever saw was made

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of thorns and the feathery blossoms of the elderberry. Apple and peach blossoms can be made to form as beautiful table decorations as ever appear on the tables of the city bred. Let us "take stock" at the first of next season and let not a single week pass without a new flower for our tables. Beginning with arbutus in April and ending with golden rod in October, we need not have a single flowerless day.

Let us go upstairs and visit the sleeping rooms. The children's first: quite early in life children begin to show artistic tendencies—crude efforts they are at first, but children ought to have some place where every harmless hobby may be ridden without fear of censure, and I know of no better place for this than their own rooms. Of course, the results may not always be artistic to our older eyes, but never mind, the children are learning and we are needed only to direct their ideas into proper channels. If one boy has a collection of birds' nests, let us furnish him with a little tree firmly fixed to a block of wood which will hold all the nests he'll collect while the fad lasts and not prove an eyesore either. Old picture frames may be made to hold his mounted specimens of insect life, while his geological specimens, neatly labeled, are arranged on a convenient shelf near the window. If our boy's room contains no wardrobe, let us make one which will serve more than one purpose. A box, say four feet long by eighteen inches wide, is furnished with castors and a hinged top. The inside is divided into two compartments, one for clothes, the other for boots and shoes. It is neatly papered inside; the top is padded with perhaps an old comfort and covered with some bright cretonne or denim; brass nails hold it firmly in place along the edge of the lid. The box proper is concealed by a deep flounce of the same material as the top and lo a combination wardrobe and couch for our boy's room, a much more decorative feature than is afforded by a drapery of men's clothing on the walls.

In the girls' room we will find curtains, draperies and many fancy articles their clever fingers have devised to adorn their own room. Both boys and girls are required to keep their rooms in order under the penalty of losing their treasures.

With a word about special decorations I must close. We must look to nature as a guide in the arrangement of her treasures. When a flower droops naturally, we must never arrange it bolt upright, and vice versa. Flowers that grow in clusters may be arranged in masses with good effect, while those blossoms that nature sets alone must be arranged with lots of green about them. Nature has a grand color scheme we would do well to study and follow in our decorating. See the pale green of the new grass starred with bluets and paler anemone. The rich hues of the flowers that nestle among the rank grass of midsummer and the rich red and yellow of sumac and goldenrod which come when the grass is seared by the breath of coming winter.

In all our efforts at home decoration let us be consistent with our

environments. We cannot fill our rooms with the same things our city cousin can, but we have at our very doors decorative material she cannot buy. Let us open our eyes to the beauties which lie in what we call common things. Let us use the material nature lays at our hand and learn with Paul "therewith to be content."

A MODEL COUNTRY HOME.

By MRS. MARY I. EBERHARD, *Clover, Pa.*

The first requisite in the location of a country home is that the house be placed on an elevation. This secures drainage and prevents to a great extent malarial diseases; and the cellar under such a house will necessarily be dry. Such a location, besides securing healthfulness, easy drainage and a prominent position, affords also a fine opportunity for laying out a very beautiful lawn. On this elevation, if possible, set the house facing the southeast, for in this manner your house will have well lighted rooms and will be less exposed to winter's storms.

The next requisite regards the plan of the house itself. The stories of the house should be of a medium height. I say of a medium height, for if the ceilings be too high, the other dimensions of the rooms will be too small proportionately; and besides the rooms will be difficult to heat. On the other hand, too low a ceiling will make a room appear "squatty" and be a great obstacle to perfect ventilation. Have the windows so placed that light will be distributed as uniformly over the entire room as possible. The windows of a bed-room should be placed so that the room can be constantly and thoroughly aired without a draught passing over the beds. Have the bed-rooms large and commodious. If you must crowd any part of the house, crowd the parlor rather than the bed-room. It may not be necessary at the close of the nineteenth century to state that the bed-rooms should not be on the first floor. Many a patient has been cured by removing him from the first floor to the second. The kitchen should not be put in the basement. This makes too many steps for the housewife, and too much heavy carrying for herself and her help; the fumes of the cooking will necessarily rise with the heat and thus penetrate the entire house, and be a source of great annoyance. The kitchen should not directly communicate with the dining room; if it does the dining

room is apt to be filled with the steams of cooking, possibly with smoke, and what is worst of all, with flies, and besides you will be subject to the annoyance—and what housewife does not dread it?—of the people at your table getting a view of your kitchen as those that wait at the table pass into and out of the dining room. Have plenty of closets. Some one remarked that women appreciate the comfort and advantages of closets as receptacles for old clothes and dirt. This is a very low idea of good house keeping and of a model house well kept. Do not allow your old clothes to accumulate in the closets. If all the service has been taken out of them, wash them thoroughly before putting them away, or if you cannot see any further use for them, burn them. In cleaning house, give the closets the same attention that you give to any other part of the house. The chimney is another part of the house that requires attention, both from point of convenience and from safety. They should be so constructed and located as to afford a good draught and security against any possibility of setting fire to the timbers that may be near them or actually running up against them. Stove pipes running through floors should be surrounded by earthen jackets. The cellar should have an entrance within and one without. The windows should be so located as to afford ventilation to the cellar, and they should be covered with screens so as to prevent insects and rats and mice from entering. Both fuel and water should be obtainable without going from under shelter. Many a woman's health is endangered by being compelled to go from a heated kitchen into the open air for water and fuel. Extreme care should be used in cleansing all sinks and waste pipes. To do this some preparation should be used that will destroy and remove any animal and vegetable matter that may lodge in them. The cheapest and most effectual preparation is a hot solution of potash. The walls of a house should not be of a glaring white as that is very bad for the eyes. When pictures are to be hung on the walls the paper or wall painting should be in subdued colors and without any marked patterns. The ceilings are most favorable to the eye when in imitation of nature's colors in the great canopy that she has spread over us, they are in blue and gray. Now set this commodious, neat, convenient and tasteful house in its proper grounds, then give attention to keep those grounds neatly. Have flowers and not too many of them to look like a florist's; have flowering shrubs and foliage shrubs, but do not crowd; have trees but not so shady as to prevent sunlight from entering the house; have plenty of grass smoothly mown, closely sown and re-sown until it grows like velvet. Do not forget to have patches of myrtle and of blue violets in nooks wherever they may be; have vines, for nothing is more delicious than a fragrant honey suckle or jasmine; nothing is more gorgeous in autumn than a woodbine. A well kept garden contributes largely to the economy and convenience of a family wherever it is possible to lay out one. The housewife, with

a little work if attended to at the proper time, will have the satisfaction and pleasure of having vegetables of the season fresh. There is a certain sense of pleasure and satisfaction in being able to set before your family a dish of vegetables that is the result of your own effort and the fruit of your own industry. The garden should be made on a slope facing the south or southeast. You will thus be able to work in it earlier in spring and thus raise your vegetables a little ahead of the season. The soil should be of a rich mould, always avoiding that of a clayey character. The old adage "A stitch in time will save nine," applies as well to the garden weeding as to the family sewing. Ten or fifteen minutes spent daily in the garden will generally be sufficient to keep the garden free of weeds. The soil of the garden should be enriched with frequent applications of fertilizer, either natural or artificial. Where a natural fertilizer is used, such should be used as is free from the seeds of weeds. The insect will be a source of annoyance to the gardener, and frequently may prove a ruin to the young plants, yet there are a number of preparations in the market which if applied at the proper time will be generally effectual in removing these enemies. I have endeavored to set out in a general way the essentials pertaining to the structural and architectural plan of the house and its surroundings and accompaniment, which form the retreat of young and old at all times and seasons and the remembrances associated with which, time cannot efface. But let us not forget that to create a model home in the moral and highest sense of the word, there must be invited into it and practiced within the four walls of the house a number of indispensable virtues, without which the house will be but an empty shell, and in the absence of which, costliness of drapery, gilt mouldings, beautiful frescoes, and all that the artist's skill can design and wealth procure can be of but little avail.

HOME.

By W. A. SNYDER, *Salona, Pa.*

In the world's domain there is no place so sacred as home. When wearied with the labors and perplexities of life, we instinctively turn, with a sigh of relief, homeward. It is a panacea for care and depression of spirits, a boon to shattered prospects, a palladium against despoiled ambitions. If it have not these attractions, it is the fault of the occupants. If the home be dominated by tyranny and selfishness

it can not be familiar with scenes of domestic felicity. The fact that children are so long in growing up and pass so many years under the care of their father and mother, is most important in the history of the race. If children remained in their home as short a time as the young of animals do, it is probable that men would never have risen above the state of barbarians. The home has been the great civilizer of the world.

Some persons are pleasanter and more courteous anywhere else than at home. A voice that is sweet when addressed to outside friends and acquaintances becomes sometimes sharp and petulant when addressed to members of the family. Some who are very gracious and thoughtful towards other people, are very rude and inconsiderate to members of their own household. One should be more courteous, more polite, more thoughtful, more entertaining and more helpful at home than anywhere else. It is only those who are courteous at home that are really courteous anywhere; for if they are rude at home, their manners in the outside world do not really belong to them.

If parents are always kind and polite to each other, consciously or unconsciously the children will imbibe the same habit—the result entirely of home influence.

The importance of the home influence being on the side of our public schools can not be exaggerated. When we consider that a common school education is all that many parents have to bestow and that they can bequeath no more priceless heritage, are we unreasonable when we ask parents to make petty sacrifices to enable their children to avail themselves of the full school term. Irregularity in attendance demoralizes the classification of a school and promotes indifference on the part of the occasional pupil. A pupil's training and education are its equipment for life. It has a priceless value apart from its utilitarian side. Dr. Schaeffer, State Superintendent of our State, says: "The choicest products of education can not be estimated in dollars and cents. Very many of the best things in life can not be bought with money; they grow and develop as the mind and heart grow and develop. You may buy a fine house but you cannot buy a happy home; that must be made by those who occupy it. You may buy a pew at church but you can not buy an easy conscience; that results from your manner of living and dealing with others. You may buy a fine copy of Shakespeare, but you can not purchase the ability to appreciate it. For the highest and best things in life there is no equivalent in money. They can only be attained by living the higher life. Education gives a man more things to think of and to enjoy, increases the range of his interests, enlarges the sphere of his activity, intensifies his life by widening his knowledge and deepening his love, and gives him power to serve the State and society in new ways and make himself felt wherever life brings him into contact

with humanity. High thinking is better than high living. Learning is preferable to lucre. It is men, not resources, that make a state."

Implicit obedience is a very essential element in the home. The parents who are not instilling into their children respect for authority, are forgetful of the interest of their own progeny. The lesson must be learned, and it is more easily learned during childhood than in youth or after maturity.

Obedience is in life what subjection to law is in the natural world. It is obedience that keeps the planets in their places and brings seed time and harvest each in its season, just as it is obedience that makes all the difference between civilized society and a horde of savages. One who has not learned to obey can hardly find a pleasant or satisfactory position in a world that both physically and socially is held together by obedience.

This is the age of books. In the home, books are not a luxury but a necessity. They both indicate and promote intelligence and culture and mark the difference between civilization and barbarism. In the progress of society, the best thought of the different ages has been embodied in literature. This represents the intellectual wealth of the world. Men die but intellectual products in proportion to their value are immortal. Homer, Dante, Shakespeare, Goethe, in their works will live, because they give expression to the universal elements in human life. Boys and girls will read something, and if undirected in selections they may perchance devour the pernicious trash with which the world is polluted and thus destroy their taste for literary gems. The boy or girl who has a taste for good literature has increased his or her capacity for the enjoyment of life and widened the individual sphere of usefulness.

Homes must be made pleasant and attractive. The atmosphere in the home must be one of social purity. The parent must be the embodiment of the virtues that trend toward ideal manhood and womanhood, if they would inculcate these principles into the lives of their children.

ATTENTION AND CARE OF THE SICK ROOM.

By Robert Grier, *Jersey Shore, Pa.*

Three things are positively indispensable in a sick room. Ventilation, cleanliness and cheerfulness. The value and importance of fresh air should never be overlooked. On it depend not only the comfort and, perhaps, the life of the patient, but also the health and efficiency of the nurse or attendant. The comfort, ease and restful feeling experienced by the sick after a sponge bath, or a mild rubbing with a

damp towel, is sufficient to demonstrate the value of cleanliness, and repay any fatigue or annoyance that may have been occasioned by the operation.

Sweeping is a great annoyance to both patient and nurse. A bare floor, with rugs or strips of carpet, is better than a carpeted floor, and can be kept clean and fresh with less risk to the patient. The bed should be placed so as to have access to each side. If you have ever tried to feed yourself with the left hand, you will readily see the propriety of being able to approach the bed from either side. I have found patients who could not retain liquid food in their mouth, when taken from the left side of the bed. A graduated glass is better than a spoon for measuring and giving medicine. All spoons, cups, glasses and vessels of every description should be kept perfectly clean and sweet. The mattress should be turned not only from side to side, but from head to foot, and if very hard, a thick, soft cotton mass should be doubled and placed over it.

The linen should be changed often, especially in fevers. The pillows and pillow-cases should be changed at least twice a day. The medicine stand should be out of sight of the patient, if possible in an adjoining room, and the nurse should keep the time of taking medicine and not depend upon the patient. All medicine should be given strictly as directed by the attending physician, unless the patient is in a good, natural sleep; "nature's sweet restorer" should never be disturbed. In hot weather, ice is a necessity, and by rolling it in an old blanket, can be kept a long time. A patient, compelled by disease, injury or surgical operation, to lie in one position for a long time, can be greatly relieved by small cushions, stuffed with cotton or bran. The cushions should be of muslin or linen.

Quiet is very essential. Whispering should never be indulged in in a sick room or near where a patient can hear. A whisper is more penetrating than soft-voiced words, spoken in a low tone. Children should never be allowed to remain in a sick room, and should never enter until after a fast is broken. Another very gratifying thing to both patient and friends should be omitted, at least in fevers and kindred ailments, that is, kissing. Admitting visitors is, in the country, a more common fault than in towns or cities. There are times and cases where no one should be allowed in the sick room except the doctor and attendant. The nature and severity of the disease will determine this.

I wish to impress upon visitors and attendants the extreme necessity for maintaining quiet in the sick room. Talking and whispering are not the only distracting noises. Jarring the bed, sitting on it, or striking the leg of it with the foot, the jar of a chair, table or stand, is often a severe shock to the patient; creaking shoes, the rustle of silk or stiffened or starched apparel, are no smaller annoyances to a ner-

vous man or woman. Old slippers, or cloth soled shoes, should be worn by the attendants.

It often becomes necessary to change rooms. This has been found beneficial in aiding recovery in cases of long and depressing sickness. This change is always attended with risk to the patient, especially in spring, fall and mid-winter. Care should be taken to have the temperature of both rooms as nearly the same as possible, and also to keep the patient from currents of air while moving. Wrap the patient up well in blankets and make the change when all is ready, as quickly as possible. While the sick room should not be gloomy, there should be, on the other hand, no glare of light. The light from the sun, gas, lamp or candle should be lessened by a screen, so as to be subdued, yet cheerful. The third indispensable requirement to the sick room is cheerfulness. On this the life of the patient depends, almost as much as upon the proper medicine. It can be exercised in many different ways. A smile, a touch, the tone of voice.

It has been suggested that I give a number of easily prepared foods suitable for the sick. Water toast, arrow-root, pap, with or without milk; panda, egg-nogg, tapioca, rice, beef tea, Iceland moss, sago, calves-foot jelly are palatable and very nourishing. Chicken broth, mutton broth or broth made from any game birds; wine whey, corn or oatmeal gruel and potato or vegetable soup. I wish, here, to enter a protest against the custom of asking a patient, what do you want to eat? what would you like? etc. Give them what you have, at the proper time and say nothing about it, till they see you with the tray. Have everything prepared in the most tempting style and displayed so as to please the eye. Make a little mystery of what you will have for the coming meal, and your patient will be much more likely to enjoy the same.

A MODEL COUNTRY HOME.

By MRS. D. H. BOULTON, *Franklin, Pa.*

In my opinion, all homes should be just as comfortable, just as convenient, just as beautiful as it is possible for them to be, in harmony with the circumstances of the owner, but when all is said and done in these directions, the fact still remains that no outward beauty or inward luxury constitutes the true home. It is an ideal of a different creation. "'Tis home where the heart is," sang the poet long ago, and no definition ever exceeded that. Tender care and loving defer-

ence lightens the hardest labor and sweetens the darkest hours of privation. A model home is one where father and mother jointly do their best to so live that the children shall ever remember their lives with reverence—where the ideas of honor, of honesty, of patrtiotism, of a responsibility to God in every day life shall be set above mere worldliness and personal enjoyment. No more beautiful poem ever was written than the Cotter's Saturday Night, by Burns, and the Godly homes of Scotland have sent out all over the world men and women who have been everywhere examples of thrift, honesty and intelligence.

To have the world the better for our having lived in it is the highest aim of humanity. The children of to-day are the arbiters of tomorrow. If their ideas are sordid and low, then will general society be degraded; if they are taught to aim high, then it will be elevated. The law of our State makes it possible for you of the country to have central high schools. You can have township halls as easily as can the boroughs have town halls. Why not have them? Why not afford to your children the advantages of culture that the residents of towns possess? If your children, for whom your homes are made, do not have them, it is because you are too indolent, too indifferent, or too ignorant to provide them. At such a central high school building as I speak of, you could have a hall where lectures, societies, socials, competitive examinations and exhibitions could be held. Such things would bring to the surface much latent talent, would kindle a spirit of mental competition, would enable you to better act for your own benefit and save you from being the dupe of every charlatan who wishes to ride to success on your shoulders. As the spiritual and mental is higher than the material, so, still it seems to me, that home is best which develops all that is good in humanity, that is patriotic in the citizen. May we all ever feel with the poet, in Goldsmith's Traveler, "Where'er we roam, our first, best country ever is at home."

HOME LIFE ON THE FARM.

By MRS. A. F. SWEELY, *Salona, Pa.*

A home on the farm is what we make it, the same as in any other phase of life. By home, we do not mean simply a home or place to live in. If it is graced with kindness and smiles, no matter how humble the abode, our hearts will turn lovingly toward it from all the cares

and tumult of the world. Like unexpected flowers along our pathway, full of freshness and beauty, do kind words and gentle acts make glad the home. A great deal of hard work is necessarily connected with a home on the farm, but, with the modern appliances found in every progressive farmer's home, the good wife can so arrange and systematize her work as to be able to find ample time for recreation and self-improvement.

I find that we make less preparation for physical and intellectual enjoyments than are made by other people no better situated financially, than we who till the soil for a livelihood. Every year, we see large numbers of our young men (and women, too), who have been struggling along on the farm, enduring privations uncomplainingly, who, as soon as parental authority was removed, have bade farewell to home and friends and gone to the city to try their fortunes in some other line of work that is more congenial to their growing natures. Just as soon as the average farmer's boy has become acquainted with the stirring scenes of life in our cities, he becomes impatient to enter the lists and battle for a foothold, and a place, among those who like himself have become dissatisfied with rural life and have found success and fortune in the sphere in which they were so well qualified to appear, owing to the fine condition of their moral and physical natures, as developed by energetic farm life. I am proud to say, that a large per cent. of our successful business men, began their lives in obscure country homes. With the practice of that perseverance which they would have expended in farm work, they have won fame and fortune. That few who go away from our farms fail, is proven by the fact that very few ever return to their old manner of living. How are we going to change this condition of affairs? In the first place I think we should make our home life more attractive and interesting. There are various ways in which this could be effected. We do not, as a rule, make the atmospheres of our homes congenial to the growth of child nature. How many of the homes of good, industrious boys and girls are supplied with the proper kinds of literature to develop their mental faculties?

If we so surround our home circle with papers and books, that the intellectual being will be continued in the boys and girls, we are sure to develop cultured, as well as contented men and women, prepared to fill any station in life creditably. Don't expect them to be satisfied with only agricultural and theological books and papers. They want something more interesting, more exciting. Have a variety of good books and papers. Be careful what you choose and economize in any other line rather than this. If there are girls in the family, be sure and take a ladies' magazine that they may keep informed in matters pertaining to womankind. I don't think that we, as mothers, should get behind the times ourselves. While old-fashioned people and things are very good, yet, I think, the young people

will respect and honor us more if they think we know as much, or a little more than they do, and dress like other people. Some people think that because they are farmers, anything is good enough for them to wear, no matter how ugly or old-fashioned. Let us surround ourselves and our homes with everything that is pretty and good, and we will be the better for it. Allow the children all the time possible for recreation, let them go fishing, boating, hunting or picnicing, or, with some of their friends, visit some place of interest. Go with them yourself when at all convenient, be interested in whatever interests them. Don't grow old so fast that you cannot enjoy a ramble or talk, or even a game with them. If possible, have a musical instrument in the home, for I truly believe that if there is any one thing that will make home more attractive than another and cause us to have a longing to be there, it is the recollection of the musical gatherings in the evenings after the day's work was done. If the boys are ambitious as farmers, give them a piece of land to cultivate for themselves, not the poorest piece on the farm either. Let them have what they raise off it, and teach them how to spend it or how to keep it. The girls, too, can make money in various ways; in the dairy, or garden or poultry yard. Get them interested and keep them interested. The wide-awake and successful farmer pays large sums of money for the latest improved farm implements and thoroughbred stock, for he well knows that this is the only way to succeed, but he is apt to complain if his school tax is raised in order to secure the services of an experienced teacher. What a great mistake is made, when, for the sake of a few dollars, we allow the mental growth of our children to be dwarfed through lack of proper training. Do you think God will hold us guiltless if we neglect the mental and moral training of the little ones he has entrusted to our care? Work with the superintendent, aid the teachers to improve our school system, give our children longer terms of school and the best teachers money can secure, and see that the boys and girls attend regularly. We must not keep them at home to work on the farm if we expect them to succeed at school.

HOME LIFE ON THE FARM.

By Mrs. E. C. Hess, *Dryland, Pa.*

To write worthily of home, is to put language to its best use, the hand to its finest work and the mind to its noblest fellow service. Only in a high sense of the value and sacredness of home can this work be fittingly performed. In the thought of civilized humanity, home is the one peculiarly dear and holy place where bud and blossoms and fruit, the richest growths of human life.

It stands in all good minds for purity, affection, comfort and civili-

zation. It is, as it were, an altar to which are brought the best fruits of the spirit in consecration, and where the ministries to the best life are more abundant than elsewhere in this world. It is so generous and catholic, and pliantly adapted to the varying conditions of men that it is the one place in which all believe, which all love, and which has blessings in which all gratefully rejoice; not the rich and fortunate only, but the poor and defeated, are glad in the peculiar and unbought helps which it has to confer upon them; not the educated and refined only, but the ignorant and coarse, find in it a certain comfort, peace and refreshment not elsewhere realized. It is everybody's place of all places, for what the heart most craves and the life is most enriched by. "However humble, there is no place like home." It has gone into story and song and the life of men, as one gloriously human and yet half divine place, which symbolizes the ideal blessedness which we crave. We can find no word more fittingly expressive of our thought of perfect life than heavenly home. And home is not only for all, but it is for the whole of life. It is not for a brief period only, as childhood, youth, middle or old age, or for seasons of peculiar dependence, but for the whole lengthened period from the cradle to the grave. The child, the youth, the man, all need and enjoy, and cannot well do without a home. In poverty and plenty, in sorrow and joy, in defeat and victory, in sickness and health, in foul and rainy weather, the home is alike, the blessed retreat and welcoming in of every human traveler through life all along the journey. To make and keep a home is the great labor of men everywhere. The poor man labors for his home and so does the rich. The toiler, with his hands and the worker with his brains, the magistrate, the judge, the teacher, the minister, the statesman, as well as the merchant, the mechanic and the farmer. The inspiration of all labor comes from the home. There are our personal wants and the wants of our dear ones, and the tastes and pleasures of the whole. There is the dear companion we love and are glad to toil for; there is the baby we would die for and the little boy who is our pride, and the little girl who is our juoy, and the blessed old mother whom we venerate, and the grand old father whom we honor, all inmates and a part of our home. We toil for them, and would think meanly of ourselves if we did not. It is called sacrifice to this, to spend our life and strength for the dear ones at home, but we do not count it so. It is our life and joy. We feel the more manly and honored, the more we do our best to make a good home and its inmates good and happy.

Why is home so good?

Home is home with such fineness of sentiment and such satisfaction for many reasons. The first is its seclusion. Men do not expect their best enjoyment in the public gaze. They retire from publicity when they want self communion or intimate enjoyment of friends. The privacy of home gives it much of its sanctity and deep

and abiding influence. It is a quiet retreat in which the domestic virtue alone can flourish, and in its repose and peace it works the miracles of its character—making results. Home must be private in the main to be a real home, and to distill in men's minds the best effects of their whole lives. Another reason for the value of home is its dependence; man is only partially an independent being. He is dependent on his Maker and fellow man for much of his best life. In his home, he depends much on his family, wife and children and friends minister to him; they warm his social nature, animate and cheer him. Every member of the family is a helper of every other member. Even the baby and the grandmother, and the poor sickly child and the crippled boy help down selfishness and keep the heart from loneliness; man, in his solitary home, is like a barren tree in a desert. He is like such a tree because he is barren of fruit; it is barren around him and he is alone, gloom and cold and cheerless. No man is independent, but every one must depend upon those nearest to him for the mulitplied ministries he always needs. If any man does not believe he is dependent upon others, let him try living alone and wholly apart from society a little while, and he will learn that our dependence is one of the things that ministers to our well being. Still another source of the value of the home is freedom. Every one is most himself in his home, because there he is free from restraint, least restraint and most spontaneous and natural. He knows his home friends and they know him. They are used to each other and can bear with and help each other better than can strangers. This sense of freedom and mutual understanding gives the essence of the home feeling. The charm of feeling at home with home friends and home things is the delight of human life. The home love is natural and must be minstered to, or life is deprived of its best experiences. No one can think of home and its power over the imagination, the home loves and their transcendent charms in the soul, the home pleasures and ministries without having his mind thronged with those vivid pictures of home life which become real to us all in our passage from the cradle to the grave. There are glimpses of the home which indicate its hold on the heart and its power over the life of civilized man, and yet these are but occasional leaves out of the great book of home life. The labor, constant and life-long for its inmates; the care, anxiety and sacrifice, continual as the succession of days; the patience, charity and fidelity, the virtue, prayer and moral heroism daily exhibited in its seclusion and unknown to the world, still more indicate its strong beneficence and power. It is beyond all question the first, greatest and best of the institutions of civilized society. But home has relations with the outside world, which tests its worth and power. Home is social, and by its very sociability creates social relations with the great public. In civilized society, there is a great outside world, made up of the business, the street, the saloon, the inn, the theatre,

the pleasure resorts, the free and easy places, where money and character are wasted. Many of these make severe drafts on the home. They tempt both young and old away from their homes, and, by their glare, and false and alluring attractions make home seem common and dull to the gay, social and pleasure loving. They create a hankering for other pleasures and life, from those of home. They sow, in the home, seeds of restlessness and prodigality. They establish antagonistic relations with the home, bid for its inmates and coquette with them for their society. These, all of them, and their number is legion, are secretly and practically the enemies of home. They very largely create the discontent which results in prodigality. How soon do parents have to contend with the street for the society of their boys. How often the wife sorrows in loneliness at home for the society of her husband, given to boon companions in some street resort. How often is the street profane with oaths, coarse with jest and ribaldry, vulgar with lewd and debasing speech that would never be heard at home. The looseness, idleness, games, drinking frivolity of the street, wage a constant warfare with the home and bring it to its severest trials and agonies.

Let us, then, as wives and daughters, do our best to make the home cheerful and pleasant, and furnish amusement that our husbands and brothers will prefer to spend their evenings at home, instead of seeking the vulgar society of the street and saloon, and thus we will exert more influence and be the happier by so doing.

A MODEL COUNTRY HOME.

By MRS. W. C. MAINS, *Collegeville, Pa.*

When a man once strongly insisted that he was the head of the house, his wife answered brightly: "Very well, my dear, but I am the heart of the house."

It seems to me quite fitting that the question of the home should be presented by a woman, and I feel honored that I was asked to open this discussion to-night. The subject is as important in its relations as any to be discussed during this convention. It lies closer to our hearts than any other, for it is mainly to increase the comfort and happiness of his home that the farmer strives to wring more profit from his farm. His best effort is put forth, he toils early and late in order to better cherish and protect his wife and little ones.

The safety and welfare of our nation depend on the integrity of the home life of its citizens. The family is the unity of society, and misfortune inevitably comes to any country where the value of home ties is underestimated. The history of the ancient peoples, if it teaches us anything, teaches us this. Corrupt Rome fell an easy prey to the home-loving Northmen.

Thus, I might treat our subject historically, tracing it from early times, or I might eulogize the home, considering it in the light of sentiment. But we are a practical people, and are gathered here for a practical purpose, and it seems to me that it were better to seek some of the means of making our homes more ideal than to merely suggest that they might be ideal.

What are some of the things which make a home what it should be? For convenience let us group them under three headings—physical, intellectual and moral. We can scarcely over-estimate the importance of the first point, the physical. And yet, to develop the first without the second and third is to cater simply to the animal nature. If we would be higher than the brutes, we must add the second, the intellectual, and, to crown, all, the moral. Then we have provided for the human trinity—the perfect man.

Thinking first of the physical, health is a blessing which we all covet for ourselves and for our friends. We realize how necessary is the full strength of all our organs in order to accomplish our share of labor. Yet how few are the men and women who can say, I am never ill. The doctor's bills, the loss of time, the work poorly done, all combine to drag down the farmer who is struggling for financial success. We know people who will say with long, solemn faces: "This sickness is sent by God; I dare not complain." But I hold that it is manifestly unjust to charge a benificent God with sickness which comes simply as the result of broken laws of health. Man is, indeed, fearfully and wonderfully made, but we may know, if we wish, many of the the laws which govern this wonderful human body. The first essential laws for the health of child, or man, or beast are very simple, but, through false economy, many a farmer pays little heed to them. Then sickness comes, and where is his profit? The wise man prefers an ounce of prevention to a pound of cure.

First, we must have dwellings, giving at once warmth and good ventilation. Modern city houses have the advantage in this respect, but a great improvement might be made on many farms, and that, too, with little expense, in the way of weather-stripping, storm-doors, sheltered walks to out-buildings, etc. I know a New England farm house where the wind blows in under the carpet, and children playing about the floor have always cold hands and feet. But the hen house is warmly built. And yet that father loves his children, and watches and works over them anxiously when they have the croup. There is no walk to the pump, and the busy wife and mother must always stop

to put on rubbers or else risk her health by having wet feet. The first duty of every farmer is to add to his house all possible comforts and conveniences. Farmers and farmers' wives are busy people, and every dollar spent in labor-saving additions is well invested. How many steps do the pump and drain at the kitchen sink save? Are there fly screens properly fitted in the doors and windows, or does your wife use valuable time and strength in a vain attempt to drive out flies? Her work is almost wholly within doors, and of the tedious kind most likely to wear out nerves and body. Does she have all reasonable conveniences and help? It does not pay to spend human flesh and blood in trying to save a few extra dollars. We shall have need of all our forces to withstand the encroachments of age and disease.

We have heard much lately concerning bacilli and microbes, those inconceivably small but powerful enemies of the human body. Contagion, we are assured, lurks on every side. It is unsafe to stay in the house, and equally unsafe to go out doors. The bacilli are everywhere. What are we to do? We have two lines of defense—first, the destruction of the germs wherever possible; second, the strengthening of the system to throw off their attacks. Greater care in securing proper drainage, greater care in destroying refuse, and greater care in fumigation would save multitudes from premature death. Too little thought is usually given to the need of thorough fumigation of sick rooms, especially in cases of contagious diseases. Two years ago, in a western city, an only child was taken sick with scarlet fever, and immediately after several of his playmates also fell ill. The disease spread, and terror and death reigned over the city. How the first case originated was a mystery until it was learned that the toys the children had played with had been sent from England after having been used by a child who was recovering from the fever. Such carelessness is nothing less than criminal. In case of any sickness, let every precaution be taken to destroy disease germs. A simple and very effective means of keeping the air in a sick room free from the exhalations of the body is a basket of lumps of charcoal. Use disinfectants freely. It is better to use too much than too little. Our homes, if we would make them ideal, must not be the lurking places of deadly germs, and the hot-beds of death and desolation.

In order to fortify our systems so as to be able to throw off contagion, we must secure pure blood and good digestion. What shall I get for breakfast? is the anxious query of many a housewife, and it is often followed in a few hours by, what shall I get for dinner? It seems as though almost all her time were devoted to the preparation of meals. Surely, what we shall eat is an all-important question. We are a nation of dyspeptics. We have a disease known among European doctors as "American nerves," and "American nerves" are not considered by them to be a good kind. We need not hope for clear

brains and strong muscles, for rosy, sturdy children and active healthy men and women if the food which furnishes brain and muscle is not suitable. The Germans say: "A man is what he eats." We need a two-fold reform. We need to eat things we have not eaten, and to refrain from eating some of our favorite dishes. We need more whole wheat and graham flour, more corn meal and less fine white flour; that is, we need more of the bone-making, strengthening properties which are now refined out of our grain. We need more cheese and less butter, more fruit and less fat. We need more milk and pure water and less tea and coffee. We need more of our food baked or boiled and less fried. We need fewer pies and doughnuts. In the ideal home, let the money that now goes into rich, unwholesome desserts buy health-giving fruits, and much of the time the tired mother now spends over the hot stove may be spent in the open air. It costs no more, indeed, I believe not nearly so much to buy the wholesome foods; it surely saves time in preparation. And, best of all, the doctor is a less frequent visitor.

Our subject implies that there is a difference between the needs and possibilities of a country home and one in the city. Our problem is to bring as many city advantages as possible into the country without bringing any of the evils. So far as our first point is concerned—that of health—the country has decidedly the advantage. Unadulterated food, pure air, sunshine, and room for exercise are some of the blessings of country life. But to come to our second point, one of the great benefits of city life is the intellectual inspiration to be gained from the lectures and sermons of great men, the easy access to public libraries and museums, and the pleasure of hearing good music at concerts and in the churches. How may something of this higher mental life be brought info country homes? To a large extent by books and papers. It is false economy to do without a few of the best standard books and a good weekly paper. I do not mean a weekly newspaper, though that is good, too, better in some respects than the daily. At least, false rumors have usually been corrected by the time the paper comes to its weekly edition. But I mean a journal like Harper's Weekly, or the Independent, or the Outlook, a paper which gives something about current political news, but something, too, about the world of music and art, of literature and great men. I have gone into farm houses where there was not a book or paper in sight, where the inmates never read what was going on in the world, and did not know of anything to talk about except the little mean gossip of the neighboring village—in fact, a perfect intellectual desert. It is from such houses that the genuine country hayseed comes. But I know others, where there is a table covered with papers and where several new books find their way into the book shelves every year. The members of such families are well informed. They might, without any embarrassment, move in the circle of city society.

There are many papers published to-day in the interests of farmers, and these are good, in their way. They bring within reach of every one the latest facts concerning the most profitable way of raising stock and produce. But the farmer needs to know something more than farming, if he would be a good citizen and an intelligent voter. The times have changed since the school days of the present adult generation. Steam and electricity have revolutionized the world. We are moving sixty miles an hour now, and he who does not want to be left far behind must join the procession of progress. New theories in farming are being introduced; so are new theories in government and politics, in education and benevolence, in church management and religion. Do you think a farmer can afford to be ignorant of these? No, indeed! Who is more influenced by a change in the tariff laws than the farmer? Who is less able to resist the iniquity of wily politicians than he? Whose children will stand more in need of a sensible, thorough, broad education than will his when they enter competition with their city brothers?

We, whose school days are over, must, in some way or other, keep in touch with the new learning. I know of no better way than by reading—reading each week the best weekly journal of current world events, and when time can be found, a standard book by a well-known author. I say again, the cost will not be great. It is no part of my purpose to suggest expensive improvements. But you have not time to read, and are too tired when the day's work is done? Interest your growing children in studying the world problems and you will be able, through them, to keep in touch with the world. There will be less gossip at table, and meal times will become seasons of intellectual, as well as physical, refreshment. In the evening, while mother sews and father rests, let one of the young people read aloud and, beside the knowledge gained, there will be a closer knitting of home ties and a greater sympathy between parents and children.

The ideal home is that one in which the good of each member of the family is sought. A family is a body, and can only reach its best when it gains the best for each member. In too many households the mother gives up her whole time and strength to serving the others, and they accept the sacrifice without a thought. It would be better if her burdens were lightened a little by each of the family, thus giving her time for rest and reading or other enjoyment.

Children, too, have rights and needs. They have the right to be well and carefully trained. In the present age, children are too much left to develop their own characters. This is partly due to a reaction against the sternness of a former generation, partly to the fact that parents have been impressed that it is wicked to interfere with a child's sensitive nature, and that much evil results therefrom. Thus, many parents have come to adopt a policy of non-interference. Would

they do the same in regard to the food or clothing of a little child? No. But is the character of less value than the body, that it should be left to a haphazard development or, possibly, to ruin? No home is ideal in which the children are self-willed, disobedient, sullen or disrespectful. It is as much the right of every child to be taught obedience, respect for superiors, self-control and sensible judgment as it is to be fed and clothed. An ideal home depends as much on its inmates as on its surroundings.

I wish that in every home in our land there were music of some kind. Nothing adds so much to the charm of home as music, and home must be given a special charm if we would keep our young people in it. Saloons and gaming houses use music to attract the young men, and shall we let evil influences have sole use of this God-given blessing? Let us, rather, give the child his music box, and, better, one that he turns himself than one that runs by a spring, and give to the boy a mouth organ and later an instrument that requires more skill. Let him whistle and sing, and let our homes be as full of music as are the woods. To an American, Germany seems like a land of music. There the well-to-do and even the poor parents strain every nerve in order to give their chidren some musical instruction, at least enough to discover if there be any talent in that direction. As a result, concerts are within the means of even poor laborers, and everywhere you may go there is the sound of music and gladness.

And beauty—God gave every one a love for the beautiful and dislike for the ugly. One of the advantages of the city is that this love may be more easily gratified. But oftentimes the beautiful is just as cheap as the plain. A pretty wall paper may be bought for just as little money as the ugliest. So may a pretty gingham. Don't crucify you little girl's taste by buying her homely dresses. Let them be simple and suited to childhood, but pretty. Nearly all the weekly papers contain a home department, in which are often helpful hints on making home more attractive. But such decorations depend too largely on the purse of the owner for me to discuss them here. It is enough to say that a pretty, light wall paper, white muslin curtains, a few pictures, a pot of bright geraniums in the window and a loose bunch of flowers on the table, may furnish a room as artistically as though each article had cost ten times as much. Only let the colors be modest and harmonious instead of loud and glaring, and let an air of daintiness pervade the whole.

Finally, though all the things I have mentioned may help to make an ideal home, something remains more necessary still. A clean, airy, well-kept house may not be an ideal home. A good housekeeper may not be a good home maker. Perhaps the very excellence of her housekeeping is at fault. It surely is if the boys are afraid to come in for fear they will be in the way. Better a boy's whittlings on the kitchen floor than a boy's heart estranged from his home, and a boy's soul

stained by the sights and sounds of a bar room. In every household, good fellowship must abound, such fellowship as prompts the sister to share the brother's burden, and him to understand the sister's need. Such fellowship as makes father and mother not simply representatives of family authority, but friends and comrades; unselfishness must hallow every act; love that suffereth long and is kind must live in every heart.

THE FARMER'S HOME.

By Miss Nora Fox, *Mt. Pleasant, Pa.*

Nineteenth century progress has become proverbial. Everywhere we hear it lauded—in public school and university, in city ward and halls of Congress, on stump and platform, in press and pulpit. It inspires the young brain of the school boy, warms up the rhetoric of the sophomore, makes the minister eloquent, the historian brilliant, and the politician feverish.

What wonder that we should so much glory in our present progress! Even the dream of Darius Green is on the very point of being realized, and we shall soon be flying or riding through the air, or be shot from Mt. Pleasant to New York through an underground tube, at so desperate a speed that none but those intent on suicide will risk it.

While nearly everything has been advancing, not all things have advanced with equal rapidity. It is characteristic of agriculture to advance more slowly than many other departments. This is due chiefly to the conservative character of country people, which results from their special environment. Yet, in the very great progress of recent times, agriculture has not been standing still. In fact, its advance has been marvelous, when we consider that in a single generation drill-sowing has displaced broadcast the mower, the scythe, the self-binder, the hand sickle and cradle, and the hay rake, hay loader and hay fork, the hand rake and the pitch fork.

Then, too, much has been said and written about scientific farming and the improved methods which this discussion has brought about have been a great help and blessing.

But this paper is not so much interested about the most improved implements and methods of the farmer as about the farmer's house. We wish first, however, to describe the ideal country home of the

future, and then notice how the homes of the present compare with this ideal.

This ideal home will have a frame or brick house, built in a neat, stylish, spacious and convenient way, but without extravagance. It will be well ventilated, well lighted by day and by night, and heated by hot water or steam. Though grate fires are more cheerful, the equal distribution of heat all through the house and the very great labor which will be saved the housewife will compel the old fireside, with all its pleasant and tender memories to give way. Dame Fashion will not permit of this home having a parlor, but it will have the same thing under a different name—a drawing room. What a noted example of progress—a parlor evolving into a drawing room! But then they tell us that we are living at such a rapid pace now-a-days.

The floor of this drawing room will be of hard wood, highly polished, with beautiful rugs lying here and there, or it will be covered with a pretty Brussels. Its ceiling and walls will be neatly frescoed or beautifully papered. Its windows will be draped with lace curtains, and comfortable chairs, rockers and sofas, will throw out a hearty welcome. A piano will be needful, that the daughters may be accomplished and that the sons may have their savage nature soothed by sweet, low strains of music. Handsome paintings, hand-painted vases, screens and other ornaments will adorn this room.

But the room of this ideal home which will, in after years, be most highly prized, will be the library, with its book case, its tables, its writing desk and easy chairs. In the book case nothing will be found but the acknowledged best. In fact, much what we now call "lovely," "charming," "thrilling," "romantic," and everything of the "blood and thunder" stamp, the more sensible parents of our ideal home will call rubbish, and will carefully see that it shall not be allowed to pollute the minds of their sons and daughters, nor waste their precious hours. It will not be the chief glory to have full sets and every book handsomely bound, but as many as possible of the best books. History and biography will predominate over poetry and fiction, at least in importance. If the shelves of this case shall present a full set of any novelist, it will be that of George Elliot, because of the greatness of her genius and the fewness of her works.

Of such voluminous writers as Dickens, Thackery, Scott, Cooper and others, but three or four of their best novels will be found. Among other novels which might be named, there will appear Confession of an Opium Eater, Ben Hur, Last Days of Pompeii, Hypatia, Jane Eyre, Pride and Prejudice, Marble Faun, Lorna Doone, Uncle Tom's Cabin, Pilgrim's Progress, Scarlet Letter, Rasselas, Elsie Venner, A Woman's Reason, Reveries of a Bachelor, Corinne and Victor Hugo's Les Miserables. All of the first-class poets of the world will be represented. Of historians, there will be the brilliant Macauley, the matchless Gibbon, Motley, Prescott, Carlyle, Bancroft, Fisk, Mack and

Master. Of biographies, there will be the splendid American Statesman Series and many others. Of miscellaneous books, this library will not fail to have such as Bacon's Essays, Heroes and Hero Worship, Representative Men, Fifteen Decisive Battles, Critical Period of American History, Social Evolution, History of the XIX Century, Seekers after God and Descent of Man.

For those of younger years, there will be histories, biographies and stories suitable to their various ages. On a spacious table, will be found the Forum, North American Review, Scribner's, The Ladies' Home Journal, Our Day, the Stockman, the Practical Farmer, and a daily newspaper. In the midst of such opportunities for improvement, the farm will be even more famous than in the past for the great and good men it shall send forth to the high offices of our land.

The dining room will be the most cheerful one in the house, for here the family will gather three times a day and have a pleasant, social time while dining. Its furnishings will consist of a handsome table, dining chairs, stately sideboard and china closet. Upon the sideboard will be seen the cut glass ornaments, while within will be found treasures of silver and fine linen. The pretty china closet will receive many admiring glances, for, upon its shelves will be found splendid hand-painted china, as well as many rare and precious dishes handed down by well-loved ancestors.

The kitchen of this ideal home will be commodious, well lighted and ventilated with everything arranged for convenience and comfort. In summer, a gasoline stove will displace the hot range, and the good housewife will no longer run the risk of being roasted and baked while roasting and baking. If the dining room be above the kitchen, a dumb waiter, manipulated by a bright servant, will carry up and down its freight of victuals and dishes.

A room not found in many of our farmers' homes, will be found in the home of the future. At a small expense, a commodious bath room can be provided, with every convenience. After once having learned the usefulness of such a room, the farmer's family will wonder how they ever could do without one. Farm labor makes such a room especially desirable, and it will prove a joy and blessing to the weary farmer if, every evening he may thus refresh himself.

Another apartment which this home should have is a conservatory, for the cultivating and preserving of fine flowers, for the ideal housewife will be fond of pretty flowers and will take much pleasure in caring for them, and in adorning her rooms with beautiful boquets.

This ideal home will be incomplete unless it shall be surrounded by a large, beautiful lawn, artistically laid out, with walks, planted with trees and shrubbery, and adorned with beds of beautiful flowers. Such a lawn must be large, much more so than is usually found about country homes, for real estate is not so valuable as in the city. Furthermore, it will be surrounded by a neat and substantial fence,

that pigs may not reverse the sod and lie down in posy beds, nor cattle go trooping through, wreathing their horns with evergreen, red roses and chrysanthemums.

This, in brief, will be, perhaps, the most important feature of this ideal home—as beautiful without as man and nature can make it, as beautiful and convenient within as the means of a bright, progressive and well-to-do farmer can afford. However, one thing more should be added. The conveniences and the servant help of this home should be such that the wife will have several hours each afternoon for resting, reading, painting, decorating china or whatever she may choose. She should have special days set apart for receiving her friends, and should possess a horse and carriage of her own, that she may make calls and take drives at her own pleasure.

While describing this ideal home some may have been thinking that it is ridiculous to imagine that a home so beautiful, convenient and elaborate will ever be found on a farm. But a home, in order to be very beautiful and have every convenience does not require the purse of a millionaire. The ideal home will not have the finest of hard wood floors or the very best of carpets, nor the most costly piano and furniture to be found, nor the finest paintings, nor the best bound books and the like, but all such things will be good, beautiful and substantial, and can be bought at a rasonable price. It will be none the less convenient and comfortable for not having the most expensive of everything. Neither will it be necessary that the young farmer and his wife have such a home at the very beginning of their career, but improvements can be made as the years go by, and as their means may afford.

Now will come a good steam heater, now a fine Brussels, now a good piano, now a silver set, now some books, and so on over a period of perhaps ten, twenty or even thirty years.

How do the farmers' homes of to-day compare with this one of the future? It will be admitted that none equal it, but that some approximate closely to it in many ways. In not a few of our country homes will be found fine carpets, neat furniture, handsome curtains, a good piano, paintings, silver, china, a nice selection of books and a good heating plant. The future will see other things added.

Amid the advance of government, education, science, manufacturing and commerce, agriculture will keep close to the front, and the farmer's home and home life will have their share in the general progress. As there will always be different grades of farmers as to intelligence and wealth, so there will necessarily be a difference in homes. But, however humble it is, there will be no place like home—provided it be neat and clean, and a bright and energetic man and wife, even if they begin in poverty, by honest toil and economy, may, in the end, find themselves possessors of a good farm, a splendid home, and with money in the farmer's bank.

WOMAN'S RIGHTS ON THE FARM.

By L. JOSEPHINE BRINTON, *Christiana, Pa.*

The term "woman's rights" is associated in a good many minds with bloomers, short hair, political meetings and the ballot box.

The particular "rights" to be touched upon at this time, as belonging to the woman on the farm, require no special regalia or peculiar dress in their exercise, and are much more "homely" than those the term usually suggests, in that they belong primarily to, and are exercised in the home, although their influence extends far beyond the home circle. However, these rights will not interfere in the least with the right of suffrage, but, rather she who is most careful to observe them, will be best qualified to vote wisely and well.

Some of the rights belonging to the women on the farm are common to all women, and some belong peculiarly to the farm. In the first place, she has a right to realize that she is helping to make one of the most sacred places upon earth—one of the homes of the nation. That it is given her to make it all that a home ought to be: a place where her husband will always find peace and rest from the cares of life, and of which her children will always think, as the best place in all the world.

She has a right to make her husband and her children respect her,—rather to keep the respect of her husband, for Eve cannot imagine a man marrying a woman when he does not respect,—by keeping her life above suspicion, by guarding the home secrets, for the true home has its secrets which the world has no right to share, and by keeping her home and herself bright and cheerful.

She has a right to put herself into the hands of a higher Power, and to keep the windows open toward Heaven. She will need strength beyond her own to be able to direct her energies, develop her faculties, and to use all the virtues wisely in order to make a success of the work given her to do. We imagine we hear some one say "Yes, she has a better chance to kill herself than anything else; there is nothing but drudgery on the farm." We admit she has a chance to kill herself, but she has no right to do it. If she starts out in her own strength, with the feeling that she knows all there is to know and has strength for anything under the sun, she is likely to be brought up in the same condition as the old woman we read of in the Philadelphia Farm Journallately, who was always tired, and was rejoiced in leaving the

sweeping and churning and dish washing of earth, and who, with her last breath, said: "Don't mourn for me now; don't mourn for me ever, for I'm going to do nothing forever and ever."

She had better go slowly and carefully and prayerfully, and while she has a right to know how to work with her hands and to teach her children that work is honorable, she should learn to manage her work and to let her head save her hands, and to know what things can be left and what must not be neglected.

She has a right to understand the details of every kind of work belonging to housekeeping. Whether she has the work to do herself or not, it will be better done if she knows the best and easiest ways of doing it, and she need not be called a drudge if she does it all herself, if she does it in the right spirit. Of course, if she says she doesn't like to do this, and just hates to do that, and if she didn't just have to work, you wouldn't catch her working, her work will be drudgery, even if it be only the lighter and easier part of the work of the house. On the other hand, she can milk the cows, or scrub the floor in the shed out there and not be a drudge. She has a right to save all the scrubbing she can, too, by having the floors oiled or painted, and by spreading down old carpet. But, we say, she can scrub that floor and make it beautifully clean, and if the floor needed cleaning and there was no one else to do it, and she is glad to do that or anything else to make her home bright and cozy for those she loves, she will find her heart responding to the song of the oriole out there in the orchard, and to the merry little wren under the eaves, both busy with their housekeeping. The note of the wood-robin across the meadow yonder, carries her thoughts to those cool, mossy places where the hepaticas and anemones grow, and her heart will be as light as her floor is white, and when her task is done she will not feel like a drudge, nor would any one think of calling her one to look at her. It is a pleasure to make clothes white and sweet. It is a pleasure to make the stove shine. She can think, too, while her hands are busy, and can even compose an article for the newspaper or magazine, if she has a mind above matter.

She has a right to call the attention of the little children and others about her to the pleasant things as they go along, that they may not miss the delight of opening buds, singing birds, the wealth of the blue sky and the green grass. She can teach contentment by telling them that, as this old farm out here is our home, it is the very best place for us, and that if it has its inconveniences, it also has its advantages. Here is plenty of room to grow; the air we breathe is not full of the dust of the shops and railroad, nor reeking with the fumes of the city's filth; the water we drink is not full of river mud; here, we do not run the risk of being choked with somebody else's gas, nor burned out with somebody else's fire.

She has a right to teach mutual helpfulness, by showing them that it

will require the help of all to do the work necessary to keep the farm. That the house will not keep itself, nor the farm itself, nor the chickens and calves raise themselves. That while she means to do her share, she does not propose to do theirs, nor to be always working while they are resting. She has no right to be waiting on folks who can wait on themselves, and who ought to be waiting on her. She has no right to be pettish and exacting, but she needs sometimes to assert herself. A friend was once telling us of a little experience of her own. We knew her to be a good housekeeper and an excellent manager, and one who could do more toward keeping down expenses than most women. On this particular occasion, she was making a dress for her daughter, and her young ladyship was pretty hard to please. She had taken special pains with a favorite dish of her husband's, and when she asked him how he liked it, he answered indifferently "He guessed it would do," or something to that effect. When the son, a young man, in his teens, came in, there was something that did not suit him. Her patience ceased to be a virtue and she spoke out: "Now, here," she said, "I have done my very best, and tried to please all of you; after this, I am going to please myself." Her words had the desired effect, as her efforts were appreciated from that time on.

She has a right to teach equal rights. That the boys are not to have greater advantages than the girls, because they are boys, and thus become overbearing and grow to despise their sisters, because they are girls. Neither should the daughter have all the advantages of education and refinement, while her brother is kept plodding, until she gets to snubbing him because "he is always going to stay on this old farm." It will not hurt her to know how to do something out of the house, and to be able to lend a hand at the barn or in the field in an emergency. On the contrary, her health will likely be benefitted. It will not hurt the boys to know how things are done about the house, enough at least that they may have an idea of the amount of work it takes to keep things running smoothly. They will be more likely to clean their boots and hang up their clothes, and, eventually, to make thoughtful husbands. If either are inclined to despise the work because it is dirty, and do not like to milk and work at the barn because the odor clings, she has a right to impress upon them that although she does not propose to have the whole barn carried into the house, yet the smell of cow is vastly better than that of tobacco, and that it is attar of roses beside rum. Some of the young folks may say that it isn't worth while for them to learn farm work, for they do not mean to stay on the farm anyway. She can help them to see that to know how to do anything and everything belonging to the farm, will not interfere in the least with any position they may hereafter take. Splitting rails did not prevent Abraham Lincoln from being President of the United States, nor from being a shrewd lawyer or a just man. Other presidents who came, both before and after him, arose to their

high positions from log cabins and humble homes in the country. Some of our most gifted statesmen, authors, inventors, physicians and professors began their careers, which ended in such distinction, as poor country boys. She can even do something to counteract the tendency growing so strong nowadays to envy, distrust and hate anyone who has money. Children hear expressions of such feelings from loungers on the corners and from numerous individuals who are not trying to do what they might because they cannot have everything that others have. They, the children, imbibe these disturbing principles, and cast slurring remarks at home about "Old Grimes" up there, just rolling in wealth and who is such a skinflint. They do not see why we have to work so hard for every penny, when such an one can have everything he wants without doing a thing. She can suggest that, as so-and-so made his money himself, possibly he has the best right to it, anyway, he will have to give an account of it, not us. He may be doing a great deal of good with it that we know not of, for the consciences of the rich are more tender than the world gives them credit for being. And then, how much better off would we be if he did divide his money up among several of us, if we have not brains enough to make anl for ourselves nor to save any of what we do make? How long would we have it? Then, he who is able to plan and carry out great enterprises by which hundreds of persons are benefitted, as well as himself, works infinitely harder than he who digs a ditch or works in a shop.

She has a right to govern her children with the help of her husband, of course. The efforts of one should supplement those of the other. If father says certain things may not be done, mother has no right to allow those things to be done, nor to hide an act of disobedience. She should teach honesty, kindness and courtesy. She has a right to beg her baby's pardon if she upset him at his play in her rapid passing to and fro about her work; but she has not right to spend an hour petting and coaxing him out of a tantrum into which he has thrown himself, because he could not have something as hard to get and as undesirable to have as the moon. A good, sharp correcting in the old-fashioned way will do more to bring him to his senses than anything else, and he will be less likely to stand up some day and tell her she is mean, because she will not let him go fishing before his wood is carried in. We do not mean that a switch should be kept on the mantle all the time. There are many children, of course, who need nothing more than a word; there are others upon whom all the words of advice and admonition and good counsel fall with as little impression as drops of water on a duck's back. Deliberate acts of wilfulness and downright naughtiness are often excused in little children by tender parents and friends, who say: "O, they will grow out of these habits as they become older." They may grow out of them, but they are a little more likely to grow into worse ones, and to become

a dread to their teachers and terrors to the neighborhood. A little firm correcting in time saves much humiliation later, and a child must be very young not to understand something of the relation of cause and effect.

She has a right to see that her children go to school regularly, and that they go with the intention of studying and obeying their teachers.

She has a right to see that there is something good to read in the house—something to interest and instruct the young, and to rest and enlighten the older ones. She may say "O, I have no time to read." Perhaps she hasn't, if she is ironing her daughter's white apron, that the daughter herself should have ironed in the cool of the morning, instead of playing croquet. Or, she may have all the mending to do and stockings to darn on Saturday afternoon, because she let the girls all go off visiting, instead of seeing that each one attended to her own share first. She should also read the newspapers and have an idea of what is going on in the world.

She has a right to have music in her home if means will allow it. Otherwise, the piano, or organ, or violin would better not be bought. If there is decided taste or talent in this direction, then here is something to work and save for. Games there should be, and plenty of fun. Sam Jones says that fun is the next best thing to religion. The real article is certainly a good thing.

On the whole, she has a right to make her home as pretty as possible, but it need not be grand to be attractive. The picture presented to the mind when a farm house is spoken of, is not one of fine furniture, rich carpets and elaborately draped windows and doorways. Rather, we think of plainly furnished rooms, not too good to use, shaded by porches and all trees; of the pantries and cellars, where may be found stores of vegetables, barrels of apples, sweet country hams and home-cured dried beef, with shelves full of canned fruits, pickles, big loaves of bread and pumpkin and mince pies, to say nothing of the pans of milk and cream. A charm of these country homes is, that no two are alike. Odd-shaped rooms and unexpected passages leading to other unexpected places are features. Unhandy and inconvenient? Yes, very likely, for our forefathers thought more of durability than convenience when they built. But the present mistress has a right to have improvements made as the need suggests them. Often the water can be brought into the kitchen at slight expense. A bay window added to the sitting room, may make the room much more cheerful, and a window in the west kitchen door will let the evening sunshine in and lengthen the short winter day somewhat. A doorway cut through and more shelves in the cellarway will save steps, perhaps, and time and strength. She has a right to have a large garden in the shape of a truck patch, where the preparing of the ground and the working of the crops can be done by man and horse. There should be room for strawberries and all the other small fruits. The solid

comfort and economy of large gardens of this kind is not to be estimated. The old, back-breaking way of digging, hoeing and weeding by hand is done away with, and a succession of plantings supplies the table with an abundance of fresh vegetables all summer, with plenty to put away for winter and often a surplus to trade for groceries, to say nothing of the pleasure of sharing with friends and neighbors. She can plant them and should see that a variety is planted, even though John should think it is not worth while, because he does not care for them. She will need them for the others who come to her table, and she should learn to cook them so nicely and make them so appetizing that even he may learn to like them. She need not insist on serving him onions, if he detest onions, instead of peas, if he is fond of peas, but she may smuggle a little onion into his soup and he will not know what makes the soup so good, or if he does, will not object to it there. She has a right to cook his favorite dishes, of course, and if he is fond of pie, she should give him pie, not every day and all the time, of course, but often enough that he may not be tempted to eat three pieces at one sitting, and so bring on a fit of indigestion or some other indisposition. Farmers can have so many good, fresh things for the table that it is a pity for them to limit their diet to a few things, such as bread and meat, bread and coffee or bread and molasses. A liberal supply of the fruits and vegetables not only adds wholesomeness to the diet, but saves a vast amount of hard work in the baking of bread for a large family. Of course, bread can now be bought by almost every farmer, yet the woman on the farm who has the average health and who studies economy, as all farmers and their wives have need to nowadays, will bake her own bread. If she doesn't know how, she should learn. She has no right to feel mortified because there is no cake in the house when company comes and not be the least ashamed to offer them baker's bread or no bread at all. It is a very good thing to be able to bake nice cakes, but the bread making should come first. Some farmers, even, claim that it is just as cheap to buy bread, but we do not know by what arithmetic they calculate. Even if roller flour be bought at the store, it is cheaper to bake, and if the roller seems necessary, a better way is to trade wheat for flour at the roller mills. The coarser grades contain more sweetness as well as nutriment, and she should, at least, insist on having a bushel of wheat ground now and then and left unbolted to supplement finer grades. There seems to be a growing disposition nowadays to get out of work, and it isn't confined to the tramps, either. Farmers themselves do not seem inclined to do anything they can hire done, and their wives do not like to do anything that can be bought ready-made. The men get so used to riding on mowers, reapers, binders, hay-tedders, horse-rakes and sulky-plows that they really seem not as able to do hard work as they once were. And here, in the house, are so many things ready-made and prepared that the women

are tempted to do less than they might. Very little butter is made on the farms now, in this part of the world at least, and the coffee is browned and ground, too, if we say the word; the raisins stemmed, fruits and vegetables canned, rounds of beef ready salted, self-raising flour, yeast cakes, soap and a multitude of other things so cheap that it doesn't seem worth while to make them. Even the mustard plasters are prepared. One would wonder almost what we do anyway to put in the time. Yet the cry of "hard times" goes on, and the farmers are looking away off for the reason, never seeming to realize that the pennies slipping away for things that are so cheap—and yet would be cheaper if they are manufactured from or substituted by the home resources—keep the dollars from growing, and the time saved in using expensive machinery seems hardly equal to the cost of that machinery which is used only once or twice a year. Time is money, they say, but it is rather difficult to see how this time turns itself into hard cash.

To come back to our woman. If her husband be a milk-shipper, she has a right to see that he has a warm breakfast before he starts to drive those miles to meet the train, and does not have to hunt the pantry for cold coffe and scraps; but she has no right to get up first in the morning in cold weather and make the kitchen fire oftener than every other mornng. She has a right to keep the moths out of the winter clothing and the mice out of the closets. She has a right to see that John's underclothing are in order when the cool weather comes, and to iron his shirts so nicely that he will not be ashamed to put them on. Of course, if she is delicate, or has a flock of little children about her and cannot get good regular help, she has a right to buy her bread and send the shirts to the laundry as her village sisters do, and have all the heavy work done, for if there is anyone who has a moral right to strike, it is the woman who works from half-past four or five in the morning to nine or ten at night, with scarcely a stop. The men who rebel at a ten-hour day have small idea of what work is. She has a right to ride in her carriage, if she can afford it, but if there is a payment to be made on the farm or bills to be met, she would better be satisfied with the old buggy for awhile yet. She has a right to go to church and to encourage those about her to do the same. She has no right to work so hard through the week that she is too tired to go to church when Sunday comes. She has a right to take an interest in some charitable or missionary work outside of home; otherwise her energies are apt to overflow in a less healthful direction. She cannot help being interested in her fellow men, and if no other channel offer, she may get to gossiping over back fences or in the neighbors' kitchens, or in the parlor, for that matter. She has a right to be neighborly without being a gossip. She has a right to know how to drive a horse and to ride one, too, for that matter. The latter is quite as healthful as bicycle riding and not such hard work o'er rough, hilly roads. She has a right to know

how to load and fire off a gun or pistol, in order to defend herself against tramps and burglars.

In short, she has so many rights that she would hardly have time to vote if she had that right. Some women we know would rather the men were so careful in selecting good men to fill the offices and so earnest to work for the right, that the women would not have to vote. However, if things are not much improved by the time she gets the right of suffrage, she will find time, somehow, to vote.

She has a right to rest and to take care of herself. If she doesn't know how, she should get John to help her. If he has forgotten how, then, maybe she has let him forget,—for he certainly meant to keep the promise he made,—by giving him to understand that she was abundantly able to take care of herself and him too, for that matter. If she never has time to sit down with him when he comes in to rest on the porch or in the sitting room, and is always too busy to take a ride with him when he is going a few miles into the country to do an errand, or into town to attend to some business, and asks her to accompany him, he very likely will forget to ask her by and by, or to consider her comfort and pleasure as he once did. No woman has a right to spoil a really good husband, or the making of one. She should lie down for a few minutes at least in the afternoon. Time, as well as vitality, is saved by this practice. If she find herself becoming fagged, she would better not wait until the stove is rubbed and every little turn done first, even if some one does come in. If the someone be sensible, she will understand, and if not, she (our woman) has a right to be independent enough not to care what opinion is formed of her habits.

She has a right to share the profits and to carry her own pocket-book. There need not the millions in it, there need not be hundreds, but something there should be of her own, and not something that is handed to her as a present from John. We do not think we have many of the "where-is-the-twenty-five-cents-I-gave-you-last-month" sort of men among our farmers, but some of them there are, who think that a woman does not need any money because her everything is provided. "Any way, she would only spend it if she had it. Women don't know anything about money." And even if she should spend every cent of it on herself, she has a perfect right to do so, for she has earned it honestly, just as certainly as the hired man has earned his, and the girl hers, and they are not called to account for the uses to which they unt their wages. It is not likely she will spend it all on herself though. She will be more apt to see something which some one else needs and which she wishes to supply, or desires a new book or periodical which all may enjoy, and will save some of it sometimes in any easy chair or some other necessary pieces of furniture. Of course, if she had property of her own, or a private income of some sort, there can be an understanding to that effect. If not, or if her property be all in the farm, then she should have a share of the money which comes

from selling the farm's crops, and not a share of the uncertain quantity which remains after all bills are made and paid at the end of the year, for that is as likely to be a minus quantity as not. She will often save enough out of her share, too, to help pay the interest on a note. If she does not have the opportunity given her to feel independent, she is likely to grow discouraged and bitter, and, although she has no real right to, she is hardly to be blamed if she becomes reckless and buys everything ready-made and ready prepared, thinking that as this is about all she will get, she is not going to work and slave, doing things she need not. John can pay the bills, as he carries the cash. It is not strange that she does not understand the spending of money as well as those women whose husbands hand in a certain amount when pay day comes, to be used in running the house. She sometimes thinks that if she had the opportunity they have, she would manage to save something too. Here, the eggs and the fruit and the extra cans of lard and quarters of beef go to the stores to be traded out, and, as these crops are irregular ones, it is hard for her to know when she is doing business on a strictly cash basis.

Finally, she has a right to understand the financial standing of her husband. Some men, in all kindness, keep their wives from knowing when reverses come, not wishing to restrict them, hoping that things will be better soon, and they need not be worried with business matters. It is mistaken kindness, for she has a right to his confidence and to share his burdens. She can sometimes see a way out of the difficulty that he cannot, and may suggest some means of lessening expenses. The worst humiliation a woman can feel comes from the knowledge of having lived in a way to bring reproach on her husband and herself, when she was perfectly innocent of any impending trouble. The more man and wife consult together the better for that house.

There is much trouble in the financial world to-day all around. Homes are being broken up and hearts rent among farmers and elsewhere. There are faults in the laws and faults in their legislation, but, while we are looking at these laws, we should not fail to consider also our own little motes—little habits of extravagance and carelessness, little leaks in time and resources that may mean so much; and, do not let us forget that there are other things beside charity that should begin at home.

ECONOMY IN THE HOUSEHOLD.

By Frances Baird Siggins, *West Hickory, Pa.*

The word "economy" is apt to suggest want. We feel that we must deprive ourselves of some coveted thing, that only in self denial can we economize. Several definitions of the word are "thrifty and frugal housekeeping;" "management without loss or waste;" "frugality in expenditure;" "prudence and disposition to save." It is not in doing without, but in doing the best we can with what we have, that we find a right conception of the word. We have but to look around us, in nature, to get our best lessons in economy.

The snow that comes sifting through the air brings with it particles to enrich the earth. We also find nutritive properties in rain water. This we can demonstrate by watching the foilage on plants where rain water is used on them. The leaves that clothe the trees in summer return again to earth, to assist in the wonderful mystery of reproduction.

"Earth gets her price for what earth gives us." The Creator has arranged that nothing is wasted in the plan of the universe. All things are gathered up and made to serve a purpose. The Great Teacher, who could miraculously feed a multitude, commanded that the fragments be gathered up that nothing might be lost.

We find that we must learn to do with fragments, and in making a proper use of them lies, to a great extent, our ability to save. But when this question comes up, we have visions of bread pudding, hash, and warmed over potatoes, when any of these, in the hands of a kitchen scientist, can be made a delicacy. The bread crumbs, properly dried and rolled, are savory; then, by judicious and careful preparation, the queen of puddings is the result.

We can all remember sodden bread puddings curiously resembling poultices, that we have eaten. Now, if we use fragments to save them, we must be careful in their use, or what we tried to save had better been wasted.

You may wonder at my use of the word scientist, but a successful cook must be a chemist. If, when we go into our kitchen, we should look upon them as laboratories, where we work out our experiments; if we would make a study of our work, and pry into the chemical action and relation of the material we use, the word drudgery would be found less often applied to kitchen work.

It is not a matter of walking around and using our hands, but using our brains as well. There is a great deal to learn with regard to foods.

By analysis, we know that some contain more of the elements necessary to sustain life than others, and in a proper use of this knowledge we can serve food that will support a working man for a longer period of time and at a smaller cost.

Meat is considered the staple article of food. We all prefer the porterhouse or sirloin, yet they do not possess the most nourishment. The vegetables that contain nearly the same nutritive qualities as meat are beans. From a cultured point of view, the Boston baked beans are best. Squash, carrots, onions and peas are equally nutritious. A great many of our vegetables are not valuable food, as they are almost barren of the essential properties. I have confined myself this far to the kitchen, as it is here that we usually find the most waste and the greatest need of economy. By saving here, the thrifty housewife can treat herself to many comforts. Have an object in view, save for some particular thing, and see how soon you can attain your object.

If your rooms look bare, don't give up and say you have nothing to make them bright with. In this day of cheap and artistic materials to work with, we can do wonders, if we but try. A few plants, some good pictures and a careful arrangement of furniture where it will look best will add greatly to the general appearance; and, above all, let in the bright sunshine and pure air, both are free. Always use what material you have to the best advantage. True economy consists in not wasting what we have, and in not having anything we cannot pay for.

It is much better to pay for your groceries and meat than to have a bill that is always larger than you thought it would be. Where several people do the marketing for a family this is usually the case. It is a simple matter to say to your grocer to send up certain articles, but if you have to hand the money to him in exchange, you will stop and consider the matter and find that, by some frugal arrangement, you can do without what you may not have the money to pay for, or save what you had intended to spend.

We should economize our strength as well as our substance, and by systemizing our work, we can save time and labor. A mechanic has his tools arranged where he can conveniently reach them, the lawyer his files of papers at hand, but the average woman keeps her kitchen utensils where, in the course of a year, she will have to walk miles to get them. Some one has said that the details of domestic economy are next to infinite, and the only way to render them tolerable is to ignore them.

We find that occasional words of praise to the toiler in the home will make the domestic machinery run smoothy. "A word fitly spoken, is like apples of gold in pictures of silver," and encouraging words will often prove both gold and silver in the home. There are a great

many things that go to make life pleasant, for which we need pay nothing but attention. Strive to make and keep a home. There is no legacy you can leave your children that is richer than the home you built for them. The memory of the old home has saved many a wayward one for the kingdom.

THE FARMER'S MODEL HOME.

By MRS. C. B. CRISWELL, *Cochranville, Pa.*

Best of all things to us, is home. It does not matter how humble it is, nor is it less a home for being a palace; it is where those we love dwell, wherever that may be, where we are valued for ourselves and not because of power or wealth or what we can do for other people. Who would be without a home? Who would take the world's applause and honor in place of the tenderness of a few true hearts and the cosy fireside meetings where the truth may be spoken without disguise, and envious carpings are unknown? In life's battle even the hero finds many enemies and much abuse, slander and distraction, but into homes, if it is what it ought to be, these things never find their way.

Providence gives no greater worldly gift than the gift of a home. Our Heavenly Father knows how sorely we need its rest, its peace, the glamor which love casts over us within it, and if there is a being to be pitied it is the one who has no home, though the enchanted purse of fairyland and all it can buy are his or hers.

I haven't any doubt but every home keeper thinks she has the model home. One may reason, my house is elegantly furnished; every detail shows wealth and taste; with exactness I manage my servants; my husband and children obey my wishes; the coming in and going out are according to a laid out rule; health and prosperity are ours. What more could I ask? Another may reason: My home has lofty domes and steeples, bay windows to the south, where there is continual sunshine, broad verandas surround the house and a well aid out lawn extends to the edge of the river where pleasure boats await our bidding; a well-liveried stable with coachman at our orders for lovely drives over the beautiful country. Still another may say intelligence holds sway in my home; my husband holds the position of judge; my sons, one a lawyer of ability, another a college professor; my daughters are educated and brilliant, while I

have been chosen state president of the W. C. T. L. Should not ours be a happy home, where so much intelligence abounds? And yet, my sisters, are any one, or all of these, essentials that go to make a model home? Once, while spending an evening at a friend's, I remarked to another lady visitor, "Haven't they a nice home?" The reply was, "They have a beautiful house." During the Civil war one evening while the Grays were resting on one side of the Potomac and the Blues on the other, the bands of each army played alternately, the Grays "Dixie," "The Girl I Left Behind Me;" the Blues "Marching Through Georgia," "Yankee Doodle" and "Hail Columbia." Finally one of the bands played "Home, Sweet Home." Then the band of the other army joined in the chorus and at the conclusion some one of the soldiers near the bank of the river jumped up on a stump and whirling his cap through the air said, "Let us give three cheers for home." Had we been there and witnessed the hurrahing, we would have realized what our American Christian homes are.

I don't see why the farmer's home should be different from the homes in the cities, and yet it is different; the wife has more care. The average farmer's wife has to be wash-woman, baker, seamstress and cook, and in many cases the vegetables and fruit are to be gathered by her busy hands from the vine or bush or tree, or dug from the ground, very different from having them brought into the kitchen almost ready to cook. One advantage in this, she gets plenty of exercise and fresh air. Aside from these differences, with all the sunbaths that are necessary, mentioned above, the city and country homes are about the same, only the advantages are on the side of the farmer's wife, whose husbands and sons have less temptation to do wrong and whose occupations are honest in the sight of God. Surely to till the soil and plant the seed is as honorable as to measure cloth in a store or count money in a bank. Moreover, it seems to us that he who assists in that mysterious process that takes so much potash and lime, carbon and notrogen, and forms them into the robe of green that hides the grimness of old earth into the golden grain that nourishes the hand and brain of toil, into the flower that charms the eye of the child, the aged, the sick—of all, he labors in closest harmony with the heart throbs of nature, and works best with the over brooding God. And when the farmer brings the charm and power of daily intelligence and intimate contact with the affairs and thoughts of men into his daily life he is living the life he should live. This is the work it is our pleasure and privilege to encourage and assist.

But the encouragement must not all be one sided. Husbands must help make this model home. Remember, "there is nothing so kingly as kindness." Too often the lover who could not spend an evening away from his betrothed, after they are married, plans to spend almost every evening away from home. And girls, the time to think about this model home is before you are married. The

young man who spends almost every evening from his father's fireside is likely to do the same from his own. If you want your home to be neat, avoid the friendship of young men who are careless of of their personal appearance. They can be just as neat in Kentucky Jean as they can in broadcloth. If you have the opportunity, use your eyes and see if things are kept neat about their farms or places of business. A neat man will be neat everywhere. A man that will speak harshly to his mother and sisters will speak the same to his wife. See that your young gentlemen friends are temperate in all things, honest, upright, industrious, intelligent, Christian, or vice versa young men.

In this model home there should be nothing to worry you. There will be plenty of work, as the following will illustrate. A lawyer asked a delicate looking little woman on the witness stand to please state to the court exactly what she did between eight and nine o'clock on a certain Wednesday morning:

"Well," she said, after a moment's reflection, "I washed my two children and got them ready for school, and sewed a button on Johnny's coat, and mended a rent in Nelly's dress. Then I tidied up my sitting room, and made two beds, and watered my house plants, and glanced over the morning paper. Then I dusted my parlor and set things to rights in it, and washed some lamp chimneys, and combed my baby's hair and sewed a button one of her little shoes, and then I swept out my front entry and brushed and put away the children's Sunday clothes and wrote a note to Johnny's teacher to excuse him for not being at school on Friday. Then I fed my canary bird and gave the grocery man an order, and swept off the back porch, and then I sat down and rested a few minutes before the clock struck nine. That's all."

"All!" said the dazed lawyer. "Excuse me, Judge; I must get my breath before I call the next witness."

There is not much use in counseling the young people with regard to matrimonial questions. They will probably not take deep interest in such matters till they meet their destiny, and when they do meet it, prudential consideration will be likely to weigh about as much with them as logic would with a cyclone. When a couple are truly united before God and the world and enter their home, they have it in their hands to make it

Neat and tasteful,
Bright and pleasant, always fair;
Where each heart shall rest contented,
Free from worldly thought and care.

But to make it a success they must take a Christ-like spirit with them. They do not want any third or fourth persons occupying chairs at the fireside. This is the time when they must learn to know each other, and how can they better do this than by themselves?

There will be differences of opinion, which is but natural, but if the true spirit presides at the hearth stone there will be no heartaches.

Husband and wife will grow alike, and are ready with prayerful preparation and patient perseverance to build their home, with love a the key-note. As for the wife managing her husband or the husband his wife, it is not necessary, for they each manage the other without seeming to know it. She is opposed to woman's suffrage; they are interested in their church work, in the temperance movement, and have time to help with word and deed in the ministration of love and mercy to those about them; and as the children are added to this home, they are received with honest love. The father and mother know that the atmosphere in which children habitually live is of more importance to their mental and moral training than any direct instruction that can be imparted to them. They realize it is useless for parents to exhort their children to be patient and forbearing with one another and to refrain from quarreling if they themselves lose their temper on slightest provocation, speak impatiently when they are provoked and follow hasty words with hasty blows. They also feel the fresh young minds, ready for instant and almost indelible impression for good or evil, are to be carefully guarded. Ghost and goblin stories are not tolerated. They insist upon their children being kind and considerate to those with whom they come in contact, feeling if they can accomplish this, they are placing in their hands the fairy wand whose touch will insure them always being loved. They teach them to pay due respect to their bodies, and in being neatly and becomingly dressed they do not allow them to be too soon in the fashion nor too long out of it. They encourage bright glowing faces made roseate with healthy exercise. As a rule, farmer's children get enough exercise without riding a bicycle, which in my mind is a doubtful healthy exercise until the riders learn to sit erect.

They see to their education and give them the best books that are authoritative in these departments. They are taught to go to nature with observing eyes and learn to interpret her manifold lessons. Their daughters are kept very close to their hearts, and protected in every way and instructed in the arts that make home beautiful and attractive. Music fills the home and rests the tired bodies after the household duties, and with kindness they lure father and brothers to join in household songs after their busy days with the farm work.

They train their boys that in all political issues to be on the side of honesty as against corruption, the best man in all places regardless of party. If more mothers would study the political issues, follow what our legislative and congressional powers are doing and thus be able to assist husbands to instruct their boys as what is right or wrong and by doing this make them better citizens, they would be doing a better work than encouraging "woman's suffrage." If it is by educating the young in the cause of temperance; that that evil is

to be driven out of this country. Why not believe if our boys are wisely trained, they will, when men, wrest our institutions from the hands of the spoilers and devote themselves to the behests of the people.

Parents of our model home believe if they wish to retain the love of their children and their reverence in after life, they must make themselves indispensable, they must convince their children there is no other spot in which they can enjoy themselves so freely as at home, and no other place to which they can more freely invite their friends. Make the home a jolly place and the young people will cling to it. The boys cannot always be kept under the parental roof, but if parents have their confidence they will be only too glad to confide in them. Those parents who succeed in making their boys interested in their home, who hold their confidence during the developing age, which counts so much, have accomplished a great end. It was my pleasure one time to visit the home of a friend of mine who had seven boys. I was surprised and delighted at the way in which that home was managed. There was mutual enjoyment and confidence and strict obedience, with plenty of fun. They had provided the home with an organ, two music boxes, scrap books for selections, blank books for pictures, relics from various places, all of which the children were familiar and could entertain with intelligence. Bric-a-brac was everywhere, but not abused. Flowers were known by their names, and these little boys were interested in them, and that little busy mother was happy in the midst of her boys with her great strong husband to take care of them. I was reminded of the "Household King and Queen:"

The happiest home I ever saw
  Was where a woman reigned;
And yet the man himself was king,
  Pray how was this attained?

The wife, who seemed submission's self,
  And did her wifely part,
Queened it in an imperious way
  Over her husband's heart.

Her chosen throne was in his home,
  Her sceptre his dear will,
Her spotless robe and crown his love;
  We see the picture still.

Yet like a king that held full sway,
  He guarded well his own,
And loved his palace home, made bright
  By love, and love alone.

The children by their mother led,
  Her bright example saw;
Obedience seemed an easy thing,
  And "father's word" was law.

Oh! what a pleasant thing to see,
  Of all things to be seen,
A home where reigns with equal power
  A household king and queen.

It is just from such busy homes as these, where Christian influence is brought to bear upon every thing, are reared the men and women who are the backbone of our nation.

REGULARITY, REST AND READING IN THE COUNTRY HOME.

By Laura S. Weinberger, *Hosensack, Pa.*

There is no doubt that many women make as great failures in the business of housekeeping or home-making as men make in the commercial world, only we do not read of them in the newspapers. The home exists for the comfort, happiness and health of the family, and when it fails in any one of these it is not a true home. The model home will describe to us all about its externals and its internals; in such a home you will find all those virtues which are the true household gods—regularity, beauty, economy, industry, education, hospitality, courtesy. Leading the list is regularity, or order, or system, or method, or whatever you wish to call it. For where order is lacking, comfort and beauty and all their attendant train will fly out of the window. Order will secure the saving of time and of strength, prevent the rapid wasting or wearing out of house and furnishings, and preserve a healthful atmosphere, inspiring to the family and inviting to guests.

Work is the natural condition of man since Eden, and even there Adam was provided with an occupation. Lawful work strengthens both brains and body. It is not that there is too much in the world to be done, but that we do not know how to do it. We make our work less by having a right way of performing it. Reason must be applied to baking, boiling and dish washing. Nothing saves labor so much as thoroughness and method. For instance, some people spend three times as much time as they should in clearing off tables and washing dishes. They pick up their dishes and carry them off

promiscuously to sink or kitchen table—knives, silver, glass, unscraped plates, cold meats, are set down together, just as it happens; cups, platters, plates, tumblers, knives, spoons, go into the dish-pan as they are picked up; the confusion embarrasses the work, and a long time is required is to get it even very poorly done.

Again, sweeping and dusting are a large part of house work, and can be a heavy tax on time and strength. Indeed, there are dozens of different ways of dusting and sweeping a room, some of them good and some very bad. It has occurred that a sweeper has gone into a room with broom, dust pan and dust brush. No windows were raised. Her head was uncovered, as well as all the furniture—everything was left in the room. The broom was not dampened and then began a process of raising the dust and of moving the furniture out of the way. I must say to her credit that when the sweeping was finished there was some dust on the pan but there was also a thick coat of it on everything else. Then began the dusting, mind you, with a brush. As soon as dusted from one article of furniture it settled on another. When all was done neither the woman nor the room looked much brighter, and yet much energy and time had been employed.

These are but two instances out of many. There is a wrong way and a right way of doing everything, and a wrong time and a right time for doing it the right way. Most people who are said to have died of overwork, died of misdirected activity, or of neglected system in their work. System is to labor, what oil is to machinery. Housekeeping can be reduced to a science and an art. Nature herself teaches us the law of order. The seasons, each with its own special work, have followed each other in regular order for a time longer than we know, and we do not look for a change. Sowing, haying, harvesting, fruit picking, fall ploughing—each has its appointed time. So with a woman's work—each task should have its special day, so each day its special task; each hour of the day its own appointed work. Have a day for washing, a day for ironing, a day for sweeping and a day for baking. Don't churn and bake and clean and wash all on one day. Be systematic. Of course, the laws of housekeeping cannot be as unchangeable as those of the Medes and Persians, but they should be as strong as an Englishman's castle, almost impregnable. We must control our work, however, and not allow it to control us. I have often seen people needlessly fatiguing themselves to perform work done to suit a rule, rather than to fill a need. I will give an instance. Irving says of the good Dutch housewives, that they keep a parlor apparently sacred to nothing but a weekly ceremony of cleaning. Weddings, christenings and funerals were permitted to take place in this beloved apartment, but for the rest it stood closed, except for its owner's weekly visit with broom and duster. It does not need this weekly sweeping—it is a mere form

that comes under the good Dutch housewife's idea of good housekeeping. Clean such a room not in use when it needs it.

Have you ever heard of people jumping in a bucket all day and then wondering why they didn't get on far, when they kept going all the time? The trouble was disorder, lack of method. You can bury more time in disorder than in any other way. Why should the housewife run upstairs for every pin she wants, look five minutes when she wants a string, hunt in every corner for scrap of rag or paper; when in the kitchen she might have a pin-cushion by the window, fancy wall pockets for string, paper and little bags, and a scrap-bag for odds and ends of rags. Have not only a set time for everything, but a set place for everything.

Many a home is wrecked on the rock of disorder. A wife may be a good cook and seamstress but she never accomplishes anything by her knowledge, for what she builds up by knowing how, she pulls down by disorder—meals at irregular hours, things left where they were last used, buttons off, hats mislaid, shoes lost, stockings mended or not as it happened, and when it happened; no one contented or sure of anything; neither husband nor children think such a home a nice place, and the wife becomes prematurely aged, fretted and worn out.

Each child should have its own bureau drawer or closet for its clothing, each drawer and closet in the house its appointed contents, so that you could find what you want in the dark. China closet, store closet, tin closet, a fixed place for everything; fixed places for bed linen and table linen; kitchen towels in a drawer of their own, so that you do not consume five, ten, twenty minutes here and there looking for things.

Order is the main-spring in housework. How could any one on a farm get on without it? In a well conducted house there is a regular month for house-cleaning and heavy sewing, and meat curing and fruit drying; a regular week for gathering herbs, for putting by winter bedding and clothes in the big chest—all mended before being put by; a regular day for sweeping, cellar-cleaning, baking, churning; a regular hour for milking, hunting eggs, feeding chickens; a regular minute for rising and retiring, for breakfast, dinner and tea; give any absent member of the family the day of the week and the hour of the day, and they know just what is being done at home. Accidents and unexpected occurrences, guests or sickness, never throw such a home into confusion. Things go on just the same whatever happens. Yes, indeed, the old clock might get out of order, but never that household.

East housewife must arrange her daily, weekly and monthly program of work to suit herself and her demands, and her good management should extend not only to times for work and places for things but to health, finance, training of children, social duties, etc. It is a good plan always to be an hour in advance of your work. Look ahead

and see what is coming and keep a little in advance of demand. Don't lose an hour in the morning and expect to make it up in the evening; night is the wrong end of the day to borrow from; work never goes briskly in the after part of the day. Don't crowd work. Notice the clock. It ticks one second at a time. Some folks kill themselves trying to wash, iron, bake and clean all in one day, and then boast of it. The Old Testament patriarchs, with their five, six, seven and even nine hundred years to live, had to figure on some way of putting in the time, and had they hurried and made all haste day by day they would never have gotten through with their spare time. We have about as much to do as our fathers had, but we have less time to do it in. We must figure so as to spend our time to the best advantage and the one hour of good judgment in planning grows to many, and you will always have time to spare, time to rest, or time to read. It is not work that kills but over-work and under-rest. "All work and no play makes Jack a dull boy." There is a proper proportion between our time and our labor; our working and our resting. A rested person, other things being right, is a pleasant person, while a tired person is almost sure to be cross. Many a family wrangle has started from a few sharp words caused by over-strained nerves. Overtired persons never look well. They look worried, frowning, dull. You see it is a matter of pride as well as of health.

But in these fast days of trolleys and bicycles where shall we find time to rest? First of all, don't work after night. The evening hours are for quiet resting of body and mind. When folks toil along in the evening after the beasts have gone to rest, somebody or something is usually to blame—vanity, mismanagement, somebody's selfishness. Have some very easy, restful occupation for evening. Reading, studying, stocking-darning, and in season fruit-paring and bean shelling. Sometimes, to be sure, as in killing time, when you are making mincemeat and sausages, the work runs into the evening; but that is only on distant occasions and does no damage.

Then let us take a fair share of sleep. All clocks need winding—so all human brains and bodies need to be wound up by sleeping. No one ever gained a permanent advantage by depriving himself of needed sleep. Regular and abundant sleep at night is needful to maintain the health of all ages and conditions. Sleep before midnight is more refreshing than after. No one who is active in brain or body during his waking hours will get too much sleep. Let him sleep all he can. Don't steal sleep hours for doing little extra things which had better not be done at all. Get to bed regularly at an early hour, and do not rise earlier than you need merely to be called an early riser, a great worker, and to boast of having your work done before your neighbors wake up.

Among the Ten Commandments we have a weekly rule for rest. Remember the Sabbath day. In it thou shalt do no work. To be

sure there are some things that need our attention on Sunday—worship, the sick, the brutes and our own proper food; but outside of these we are to rest. In some parts the farmers haul their milk to the creameries on Sunday, but I believe if they were compelled to give the Lord the price of all the cheese and butter made on his day, they'd find means to keep the milk over Sunday.

Then we have a number of holidays each year which we should observe with our whole families in some such way as shall give the most change to the current of our thoughts and cares. We have New Years, Washington's birthday, Easter, Fourth of July, Labor Day, Arbor Day, Thanksgiving, Christmas—a number of days for rest and recreation. As the reach between some of these is pretty long, I should throw in a birthday keeping, a picnic day, a festival of some kind, and these days will be found to strengthen family ties, freshen health and interest in work, and give a new spring of vitality to all our labor.

There is also great rest in mere change of labor. It is not so much when one is tired, that one needs to drop everything and lie or sit down with folded hands. This is sometimes needful; but there is true and effective rest in bringing into action an entirely different set of thoughts and muscles. Thus one who is tired with sweeping, scrubbing or ironing, can rest thoroughly by bathing hands and face, taking a foot stool and a comfortable chair and taking up some sewing.

Do what you can to lighten work; not in the way of allowing neglect, for that never really makes anything easier, but by furnishing any possible appliances to make the work easier—washing machines, clothes wringers, sewing machines, water conveniences, everything you can afford. Use ammonia and soda. Do not stint the kitchen to trick out the parlor.

Train up your children in habits of industry and helpfulness. Teach them first not to be troublesome and then to help. The little things can bring in wood and chips, feed the chickens, open and shut doors, and so on to larger and larger things. To be sure they will make mistakes and perhaps make more work in the very efforts to help, but remember that you are working for the future; that you are moulding them into such men and women as they will be, and as you teach them now you will be helped by them after a while.

Mind and body are so closely connected that the mind can tire out the body by carrying burdens even if they are only imaginary. We wear out minds and bodies by enumerating to ourselves our future toils. To-day we are ironing; and if as we iron we forecast how hard it will be in the spring to dig the garden and plant all the seeds, how much weeding there will be, how very hard the spring cleaning will be, how many jars of pickles, jellies and preserves there will be to put up, why, then, taking trouble in advance of need and paying

heavy interest for it, we needlessly exhaust ourselves. The burden will be too heavy for us if we add to to-day the weight of to-morrow.

Some women must learn to distinguish between the needful and the needless. I have seen thin, haggard, worn-out women, who were perishing for rest and recreation, instead of taking that needed rest which would spare them to their families, actually sitting for two or three hours each day for months darning into fine fancy patterns the quilting of a bed-spread which did not make the quilt any warmer or any stronger. A million times better spend that time in the garden raising flowers, or in the yard raising chickens to sell and buy counterpanes, if they could not be had without such management. Some women sit up late at night knitting lace, and hours thus stolen from rest will soon send them under the church-yard sod, where neither lace nor ornaments will benefit them. When it comes to this closest question of labor-saving, when only one pair of woman's hands is ready to do a family's work and that woman must have resting time, let her cut off scrupulously all labor that is for mere ornament in dress and furnishings; let there be plain hems now; by and by these little girls will have grown up, and these boys will be old enough to help more, to bring in less mud and to wear out less clothes, and then you can have what you now crave in pretty things and your common sense denies you.

We have societies for prevention of cruelty to animals and children. I wish we had a society for preventing house-wives and house-mothers from being cruel to themselves. They think it looks foolish to lie down in day-time, that it looks lazy to sit while they pare vegetables or mix cake, wipe dishes or polish knives; that it looks extravagant to cover their working tables with oil cloth and to use plenty of mats and rugs, and ammonia and borax and soda for cleaning, instead of driving all their own failing vitality into scrubbing brushes.

The best rest, the only real rest, is to lie down on something entirely comfortable in a shaded room and relax every nerve and muscle as much as possible. Five minutes at a time several times a day—and more if possible—of such rest will certainly add to length of life and and happiness. Do this, even if it deprives the family of their dessert at dinner or their warm biscuits for supper, or their cake for over Sunday; it will be much better for them to lack these things for a few times, than to endure a six months' reign of a stranger in the kitchen, or even worse, to go to your own funeral.

When you feel languid and weak, unattracted by out-doors, and when to move eyes or hands seems as hard as to move feet, be wise in time; go and rest; rest often and in the right way.

I have heard it said that the monotonous life, the drudgery of house work coming from a large family, a large dairy, and too little help brings many farmers' wives into the insane asylum. There are two ways of ascending a tower 100 feet high. Quietly ascending the

stairs, you reach the top but little fatigued; you seat yourself, look at the scenery, rest, return; you are none the worse for the climb. But start at the bottom and run with all your might up those stairs; stand purple and panting in the wind on top; turn and run down if you can, and very likely you will soon drop dead, or live all the rest of your life an invalid, the victim of your folly. Yet many farmers' wives act just as foolishly. They forget how minutes of rest lessen the total of the day's fatigue. Many wives and mothers could have been spared to their families by having each day an hour's rest in the rocking chair or on the lounge, fifteen minutes with an entertaining book or fifteen minutes out in the open air, not working at but looking at the flowers in the garden, or the poultry in the yard. But they could not take this time. It had to be spent at the sewing machine putting six-pin tucks in the frills of pillow shams, sixteen tucks in their daughter's skirt, edged ruffles on the little girl's apron, frills on the baby's frocks, puffs, tucks, or inserting in something else. Mothers are worth more than tucks and ruffles.

A house-wife's life need not be monotonous. Many of her tasks require no mental effort whatever, and while her hands are busy her mind need not be idle. Her whole life would seem less common place if she could busy her mind with some interesting subject about which she has been reading, while performing the daily routine of her work. There are many families right here in this progressive section of the country where the whole family library is comprised in the Bible, Stark's Gebet Buch, Heidelberg Catechisms, and the only paper taken is the Bauem Freind, or the Familien Freund, and this in families where there is ample means to supply good and sufficient reading matter for every member of the family. The books mentioned are all right, but they will hardly suffice for a life-time of reading, and as for the children of the family, how very few are taught to read in German at all. Each family should take a daily paper, a weekly local paper, and at least one monthly magazine. You will never miss at the end of the year the 10 or 25 cents paid each month for a good magazine. You will enjoy talking over the news and various articles at meal time. There are other matters of interest needed to converse about than the price of potatoes and the draught of the kitchen chimney.

It is my opinion that one of the chief ways of making home happy, thriving and useful in its influence is to supply it well with books and papers. A home without books or newspapers compels its members to find entertainment and interest, which they will inevitably seek, away from home—the girls in silly gossip, the boys at the store or in the bar-room to learn what is going on in the world, and most likely the news is mixed with much else not at all desirable or elevating.

The papers contain not merely the current affairs of the day, the

news of the church, politics, foreign affairs and market reports, all valuable and without which a man can hardly be a respectable citizen or a decent manager of his own business; but these papers also contain valuable information on subjects of health, of farm work, of household work, cooking, cleaning, the care of animals, and of fruit and vegetable culture.

Teach your children to respect books and furnish them with books they can enjoy, even at the cost of a little self denial, and later teach them to buy books out of their own savings. Give them a setting of eggs, a lamb or a calf, and when these have paid their board, encourage the children to spend the remainder for a magazine, a book or a paper. You can soon build up a library in these days of cheap books. You can find books suited to all ages, conditions and tastes, on all subjects possible. For the child Fairy Tales, Mother Goose, Jack, the Giant Killer, Red Riding Hood, Robinson Crusoe, Arabian Nights, Pilgrim's Progress. As the children grow older the toy books give place to tales of history, travel, explorations, and the fairy tales of science. Give them books on insects, birds, flowers, and they will learn to keep their eyes open. You fathers and mothers will enjoy reading these as well as the children. For the housewife there are books on housekeeping, cooking, decorating, on gardening, on health —anything to improve and beautify the home. For the head of the house there is biography, history and numerous aids to his work. And beside this all, there is no end of good fiction from which to choose for both old and young. In the line of magazines and papers there is just as great variety. Wide Awake, Harper's Young People, Youth's Companion, for the children and the older folks. The Household Companion, Ladies' Home Journal, Farm and Fireside, Farm Journal and all the daily and weekly newspapers beside the elegant monthly magazines—McClure's, Harpers, Century.

There is no famine of reading matter, but where are we to find time for all this reading. Our days have only twenty-four hours. We must work and we shall also rest. When shall we read? Read whenever you can. Count that day lost when some moments have not been snatched for reading. You will find this snatching for moments a greater thing than it seems at first sight. You will find that much of your most valuable reading will be done at those odd moments when you might have done nothing at all. The housewife should keep a book on the kitchen shelf, a little rocking chair by the window and she can comfortably read many pages in time which otherwise would go by idly in waiting for things to cook and to bake. Do not think that this will mean underdone beef, watery potatoes, burned soup if you allow books in the kitchen. You have baked a loaf of bread, made a pot of soup, and ironed a shirt all at the same time. You can keep dinner and books in mind as well as ironing and dinner.

You go to call upon a friend. You find that she will see you in a few minutes. Don't waste that few minutes—they may grow ten. Take up a book. All parlors should have books in them and light enough by at least one window to see to read them. A bookless parlor is a howling wilderness; books are more important in furnishing a parlor than card cases, vases and knick-knacks of all sorts. Take up a book while you wait and spend the time in reading.

However, I do not think you have done your duty when you only pick up a book in spare moments. Morning hours are golden hours for reading, but very few if any of us can spare the time then. Evening is another excellent opportunity. Then work is done, hurry and excitement are over for the day. We are not thinking of the morrow's tasks; nothing lies before us but to seek our rest. With good print and good light, here is a happy space for reading.

There are in many households some whose eyes will not permit them to read much for themselves; or there are some who cannot well spare time to read. The busy mother would like to read a book or the newspaper, but she has the family mending to do. How much more swiftly will her needle fly if some one reads aloud to her. Little children like to have some one read to them and it cheers many a weary hour for a sick person.

With very little self denial the home can be furnished with varied and useful reading without which it is like a garden without flowers.

Let me draw a picture—A large family, the mother amply aided; all things in order, work done beautifully and systematically; intelligence reigning; time for rest, for books, for social life; every member of the family proud of his home and content to be in it. Let the home be as nearly like Paradise as possible—a blessed oasis in memory.

HOW TO CARE FOR THE SICK.

By IDA M. DICKENSHIELD. *Hosensack, Pa.*

There is no subject of greater importance than to know how to properly care for the sick. It will, however, be impossible in the time allotted to me to enter into detail, but I will briefly give you a few suggestions as to how the sick should be cared for, and some of the most important things to be done.

The very first canon to be observed is to keep the air inside as fresh as out, by night as well as by day, without chilling the patient.

One of the best and simplest methods of ventilating a room is to have a board about six inches or a foot high fitted tightly under the lower window sash. This will admit a current of fresh air, the impure air passes out and causes no draught. Do not ventilate a patient's room by opening an inside door; this does not give the patient fresh air but draws all the impure air from the rest of the building. Always air from the outside.

Second only to air is light, not only daylight but sunlight. The bed should be placed in the best position to secure air without draught, and light without glare. This often necessitates the rearrangement of the whole room. There should be no unnecessary furniture in a sick room and that which is retained should be as simple as possible.

The greater part of caring for the sick consists in keeping everything clean. No ventilation can freshen a sick room where the most scrupulous cleanliness is not kept. Clean air, clean water, clean surroundings and a fresh atmosphere everywhere are the true safeguards against infection. You cannot lock in or lock out the infectious poison. You can, however, air it out, diffuse it and clean it away.

Dust is the harborer and harbinger of disease; consequently the furniture in a sick room should be such that it can be wiped with a damp cloth, wrung out of hot water. To dust, as it is often practiced, mearly means to distribute the dust more evenly over a room. To tidy a room, or put a room to rights, means to remove a thing it has kept clean for itself on to another and a dirtier one. Not an atom of dust ever actually leaves a room under this system of dusting; but with a damp cloth or chamois almost every particle of dust can be removed.

An easy way to keep a room clean is to have no carpets, but a few rugs that can be taken out and cleaned and the floor wiped up with a damp cloth.

The best bed is a metal bedstead, woven wire spring, hair mattress, cotton sheets and blankets for covering. No heavy cotton comfortables or counterpane. Do not have a patient lie on blankets; this acts as a poultice and causes bed sores, the symptoms not of disease but of nursing.

Feather beds should also be vanished from the sick room, hair pillows used in preference to feather pillows, especially in fever cases. No Valance or heavy curtains, and if possible two beds, one to be occupied during the day and the other at night. The bed should be placed so that the patient can see out of the window.

A physician's orders should be strictly obeyed, and his only; friends coming in with their advice and their remedies should be ignored. Or, should they have more faith in their friends than they do in their physician, why not leave the physician away and adopt each and every

friend's remedy? for a physician's and a friend's remedy very seldom agree. Medicines should be given regularly, and one person should be made responsible in this matter, for if each one in the family give the medicine there will be confusion and often the patient will suffer. Medicines should never be kept where the patient continually sees them. Keep them in the hall or the next room.

Food is no less important than medicine. Two chemical rules can be given for this as absolute. The patient's stomach is the laboratory and also the chemist. Food should be given regularly and served in the most appetizing way. In serious illness the physician's advice should be taken in regard to quality and quantity. In convalescence from typhoid fever, one single false indulgence has often caused a relapse and even death. Visitors should be excluded from the sick room in serious cases, and only those caring for the sick should be allowed in the room. In convalescence a few short visits are admissible, then only bright and cheerful conversation. No unpleasant or excitable topics should ever be discussed in a sick room. You should always be kind, but never emotional. To call on a patient by emotion for emotion is most cruel, because it is a useless demand on his strength. It is asking him to bear your troubles as well as his own. Suppressed emotion is as bad; it makes you constrained; it is exposing your patient to both frost and fire.

Half the battle in caring for the sick is to relieve them from having to think for themselves, least of all for their own nursing.

"DON'TS" FOR FARMER'S WIVES.

By Mrs. Thomas W. Houston, *East Brook, Pa.*

"Don't" be a farmer's wife unless you understand the situation thoroughly, and are willing to take a goodly amount of prose along with the poetry of life. I know there is much said and more written about the independent, joyous life on the farm—how a farmer's wife lives near to nature's heart, has the advantage of the fresh morning air and the beauties of the sunrise, etc. With all due deference to these writers, I think this sunrise business is a little over done. I'm sure there are a few of us, at least, who would be willing to let the sun rise alone in his glory occasionally while we take another nap, if it were possible to do so. I remember a picture that was popular in the days

when the chromo flourished, of a very much be-crimped and be-curled maiden standing in a clover lot beside an enormous basket of wet clothes. It was entitled "Spreading the Linen to Bleach," and a taking couplet beneath tells how in early morn she goes forth, her little feet brushing the diamonds off the grass as she trips lightly along. Why, the scene is sweetly pretty. You can almost hear the twitter of the robins and the song of the sky lark. You grow quite enthusiastic. You want to rush right off and get out in the clover with your washing and look as pretty as she does. But wait a minute; a little reflection will tell you if she carried that basket out there her arms are tired and her back aches. If she knocked off many diamonds her ankles are wet and her skirts draggled, and moreover, as you think a little longer you are convinced that the whole thing is a fake, for if she stopped first to do her hair in that bewildering fashion she never got her clothes ready to spread until long after the sun had taken care of the diamonds.

So don't be taken in with all this pretty talk of the romance of the farm and think there is nothing else in it, but look fairly on its more serious side as well, before you make up your mind.

But, having "put your hand to the plow," let there be no turning back. In other words, having put your hand in Joe's, John's or whatever your farmer's name chances to be, don't, for mercy sake, make the far worse mistake of seeing all the prose of your life and none of its poetry. The poetry is there all right, and now it is your business to look for it and enjoy it as it comes to you.

Don't wear yourself out doing things that are not necessary. There are many, many things that can not be left undone and the peace and prosperity of the family be preserved, but are there not other things in which you could save yourself a little and nobody be the worse? If you have a bare floor, don't scrub it. Paint or oil it, so it can be cleaned with a mop with half the work. Many of you iron every scrap of your washing until it is guiltless of the suspicion of a wrinkle and you are so tired when it is done that you get a "life-is-a-toil-and-love-is-a-trouble" sort of a look on your face, and it's the hardest kind of work to get up a smile for John and the children at supper time. Now, don't you honestly think you would be doing your family a favor if you ironed your table linen and things that must be done, just as nicely as possible and then fold your ordinary sheets, towels, etc., and gave them the traditional "lick and a promise," and save your strength for the many other duties which are crowding you? Put it to vote in the household and see what they think about it. "But," you say, "this is bad house-keeping." Not a bit of it! Nothing is bad house-keeping that is good home-making, and it is surely a good plan to keep the main spring of the home in the best possible order. If time hangs heavy on your hands and you long for something to while away the hours, then, by all means, give

everything a John Chinaman polish. I'm not talking to you; I'm talking to the average farmer's wife, who sees fifty things to do and only forty-five minutes in which to do them.

Don't be "set in your ways." Don't think you have the only right way of doing things and refuse to try any other. Don't despise the washing machine, the gasoline stove, the carpet sweeper and the many other labor saving devices, because they are new and different from the old ways of doing things. Avail yourselves of every modern convenience that comes within your means.

Don't forget how to laugh! If we laughed more, we should all be healthier and happier. True, we are a very busy and a very practical people, and many of us may find more in our lives to bring the frown than the smile, but, nevertheless, it's a pity we don't laugh more. The October Ladies' Home Journal tells of a woman whose life was filled with a succession of crushing sorrows. She determined to throw off the gloom which encircled her and made a rule that she would laugh three times a day, whether a cause for mirth presented itself or not. She followed her rule faithfully with the happiest possible results. Her health and spirits were restored and in a little while she had no need of her made up laugh, for when she looked for it she really saw a bright and humorous side to many things that looked all dark before. Not many of us will need to force our three laughs a day if we cultivate the habit of seeing the funny side of things. There are lots of things that are honestly amusing around us every day, but the trouble is we don't always see the fun in them or feel like laughing at it if we do. A few days ago I was called out of the kitchen just as I had a pan of biscuit ready for the oven. Returning a little later, I found our youngest hopeful proud, black and happy, sticking the very last feather out of the stove brush into my biscuit, delighted that his trees, as he called them, would stand up so well. The buscuits were a hopeless wreck, of course. That was a pity. The baby son must be made to understand that his offence was a grave one that must never be repeated; but after all it was very funny. If I had gone into your kitchen and seen that grimy little figure poking black feathers into your biscuit, I should have laughed, and would'nt it have been too bad for me to have lost the laugh just because it happened to be my baby and my biscuit? I think it would.

"'Tis better to laugh than be crying;
'Tis better to sing than be sighing."

Don't be ambitions to do more work in a shorter time than any other woman in the neighborhood; don't fidget yourself into a fever if your house is not always in the apple pie trim you would like it to be. It's nice to have it so, I know, but a house has to be lived in, and it will get torn up, and if with the many other duties you can't get round all the sweeping and dusting in one day, let it go until

the next, and don't lie awake that night worrying for fear some of the neighbors come in in the morning before you get the top of the front door dusted or the cobwebs swept out of the cellarway. Don't make such a hobby of neatness that you drive your family away from home for fear they get things out of place. Don't be continually telling your husband that "order is heaven's first law." It gives him a chance to make cutting remarks to the effect that it will be a happy day for him when you have gone where the law is enforced. I don't suppose he would be so mean, but still it would be as well not to put temptation in his way.

Don't think it beneath your dignity to fall to and help your husband along with his work if he is in a rush. It won't hurt you to drive the cows down, milk them; yes, and feed them, too, once in a while in a busy time. I wouldn't do it too often, for the men, dear creatures that they are, are very easily spoiled and may come to expect it of you always. Have him understand that you do it as a favor. He will appreciate it and watch for an early chance to return it, I am sure, for there are as gallant hearts beating under the coats of the Lawrence county farmers as any place on earth.

And the children, God bless them! Don't let anything interfere with their having a happy childhood. Whatever may be said of the disadvantages of farm life after we have grown, it is unquestionably the very happiest place on earth for the children. Let them enjoy in fullest measure the wagon rides, the wild romps in the meadow and barns, and when winter shuts them in, don't object to having your chairs used in turn for horses, trains, threshing machines or saw mills. Make a noise? Of course they will. Plenty for your own family and some for the neighbors; but you remember what Bob Burdette says about that? "Let your boy go away and you can hire a brass band to play in every room in the house to drive out the awful quiet, but it can't be done; the quiet has come to stay." Remember the children's birthdays, if it be only to have his favorite dish for dinner served off the prettiest china. Many ways there are, costing little in either labor or money of making holidays different from other days to them. We can surely give pleasure in little ways while waiting for the larger opportunities. Our children are our very own for such a little while. Outside influences begin so soon. Drop by drop into the clear well spring of childhood will fall the bitter waters of experience, and it is a sad truth there is no filter this side of the grave can restore its original purity. Our children go out stronger to battle with evil, stronger to help others, make better men and women for having had a bright and merry childhood.

Don't look black as a thunder cloud if your husband comes in to dinner bringing with him a man you knew not of. It's a dreadfully hen-pecked husband that don't dare to invite a man to dinner with-

out first asking his wife if he may. Don't make any change in your arrangements on account of your chance guest; and worse than all, don't apologize for what you have, making the stranger feel that he has mortified you. I don't care if you haven't a thing but boiled potatoes. Serve him his potato with so gracious an air that he remembers after he goes out, not what he had for dinner, but the kindly hospitality, and is glad he stopped.

Don't sew at nights—with a possible exception of the ever present mending. Not many of us have much time through the day for reading, and I insist upon it that our evenings we must have. You owe it to your family as well as yourself, to, in a measure at least, keep up with the times. Keep posted as well as circumstances will permit, on the leading questions and current topics of the day.

Read the newspapers. There is a wealth of information in them. Don't skip all the politics, either. I know you can't vote, and I'm glad of it; but that need not hinder your having an opinion of your own, and more, a reason for that opinion. Then, too, there never was a time when there were so many low-priced but high grade books published as now. Avail yourselves of them. You used to be called a very delightful letter writer. How many letters have you written in the past year? Haven't you let your correspondents drop one by one as the calls on your time increased? This is not right. Keep in touch with the outside world by writing and visiting your friends in other places whenever you can. It will keep you from growing warped and one sided, as we shall surely be if we live too much in ourselves. A woman in the centre of a home certainly needs a broader view of life, a larger outlook, than the daily routine of housework.

Don't cross bridges before you come to them. Don't begin to worry about the spring house cleaning right after Christmas. Some of us allow a whole season's work to pass in review before us over and over again, as if to remind us that there is no such a thing as rest for the busy housewife and mother. Not that I would discourage planning and thinking the work over when the time comes. But this we should do in a practical, common sense way, not with a morbid brooding and fretting. The woman who conducts a spring campaign of house cleaning, garden making, chicken raising, soap boiling, spring sewing, etc., etc., etc., etc., to a successful issue must think and must have a mind for details.

Some woman who had better have been sleeping the while, has brought her arithmetic to bear on the three meals a day question, and finds out that in a year she will have to cook one thousand and thirty-five meals. Then the immensity of her task overcomes her, and she s nds a doleful wail to the farm paper pitying herself and all the rest of us. She forgets that we don't have to get dinner until the breakfast dishes are washed. Getting one meal is no very great task, and we

only have to get one at a time. Summing up your work like this has a depressing effect and should not be encouraged.

Don't think you would be happier some place else than on the farm. You wouldn't; or it is not at all likely you would. Show me a woman who is discontented on the farm and I will, nine cases out of ten, show you a woman who will be discontented wherever she goes. Discontentment is largely a habit, and a very bad habit it is. Our life on the farm, in spite of its rought spots, has many redeeming features that belong to it and it alone. William C. Gamutt, in his beautiful and helpful sermon called "Blessed be Drudgery," says, "If I can not realize my ideal I can at least idealize my real." Does this seem strained and unreasonable when applied to household care and duties? We need, by sheer force of heart and mind, to rise above what is distasteful and monotonous in our lives, and see life as a whole and our work as a part, small, of course, but still a part of the universe and the universal plan.

> "All are but parts of a stupendous whole,
> Whose body nature is, and God the soul."

So cheer up, sisters. Let "look up, lift up" be your motto. May you grow younger at heart every year and time's finger leave never a wrinkle on your face.

THE YARD AND GARDEN.

By MRS. S. B. FRITZ, *Duncannon, Pa.*

The ideal home on the farm can not be pictured unless surrounded by trees and flowers. We all like to have our homes neat and attractive. Nice surroundings add very much to the enjoyment and contentment of people.

We can have a beautiful yard with little expense if we go about it in the right way. If grass has become poor and mixed with weeds the best plan is to turn it all under, then make a smooth, clean surface and have the soil fertile. Now sow a good grass mixture (Kentucky blue grass and red top are highly recommended), and in a few months you will have a nice velvety carpet of green, if you keep it closely cut. In the planting of the yard, be careful not to overcrowd; have some system in arranging your flowerbeds; also have some nice shade trees. I do not advise fruit trees for yards. I think it more suitable to have some forest or ornamental trees. I

would advise all farmers to have a hammock in some shady nook or on the verandah to rest in during the noon hour. If once tried, very few will be willing to dispense with it.

Many a tired farmer would lie down for a half hour's rest during the long tiring days of summer if it were not for the heat being so great he can not rest comfortably. In a hammock the air has free access and the gentle swaying induces rest. Who will deny that the time thus spent is made up in full by the better work that can be done owing to rest so obtained?

Many lives would be prolonged by taking much needed rest. It is the ceaseless rush and hurry that kills more people than actual work, and as the farmer's strength is part of his capital, it is advisable for him to husband it much as possible.

In starting a garden on an ordinary piece of ground which has not before been used for this purpose, it will take a year or two to get it pulverized and enriched sufficiently to produce a first class crop. It is therefore necessary to keep the same ground for this purpose. To have a garden do its very best you should have a system of rotation of crops. I advise the garden to be made long and narrow, instead of nearly square in form, as most gardens are. You can then use a horse cultivator to advantage. A garden 8x20 rods is cultivated with a horse at much less expense than one only one-fourth as large worked by hand, and I think produces better crops, as the soil is kept better tilled. Use only the best of seed to insure the quickest and largest returns.

When plants are ready to transplant it is not necessary to wait for rain for a week or more, as some people do, but as soon as the ground is fully prepared put the plants in a pail or bucket having a little water in the bottom. The roots set in this will absorb so much water that the plant will endure a drying air after being set in place. If the ground is very dry, pour a little water in before planting, but put none on the surface as this forms a crust and prevents the free circulation of air which is so essential to profitable growth.

Of the common vegetables it is not necessary to speak, as you find them in all gardens, but there are a few things I wish to call your attention to. One is a vegetable rarely found in gardens and it should be in all, namely, asparagus. When a bed is once started it will last for years and annually furnish one of the earliest and most delicious vegetables. In addition to this, it has very valuable medicinal properties.

Then, too, every garden should contain some rows of strawberries and raspberries. The free use of vegetables and fruits should be enjoyed by every family the year round. The children especially should be treated to all the luscious fruits, fresh and preserved, that they may desire to eat. None should be deprived of the excellent food found in the choice vegetables and fruits so easily grown.

SOCIABILITY IN COUNTRY LIFE.

By Mrs. T. E. Armstrong, *Tionesta, Pa.*

It has been apparent for many years that there is a growing discontent among farmers and farmers' families. No matter how great may be the moral, physical and financial benefits derived from a life on the farm, there still remains the desire to associate more with their fellow beings, and to be in closer contact with what they consider the more fortunate portion of our population, that is, those who reside in city or town.

It is true, there are not so many persons needed now on the farm to do the work as were required a quarter of a century ago. This is due, in a great measure, to the many kinds of machinery which have been invented for the farmer's benefit.

What formerly required several persons several weeks to accomplish may now be done in as many days. This is specially true of the harvest season; hence the boys, yes and girls, too, rush off to seek their fortunes elsewhere.

One other reason why so many of our young men are anxious to leave the farm, is that so many of our young women do not consider farmers' sons so desirable for life partners as are the young men reared in town.

This is a false idea; for whatever may be lacking in the "rubbed finish" of the man, will generally be overbalanced by his sterling integrity, correct idea of morals, and his industrious habits, usually acquired with life on the farm. While he may not be able to discuss the latest plays or the newest figures cut on the waxed floor of the dancing hall, there is no reason under the sun, why his better-self may not be as well cultivated as his city cousin.

It is a well known fact that country boys and girls are capable of filling important positions, both in the trades and professions.

I have in mind a little country church which in a few years sent ont nine of her sons to preach the gospel and some of which are now filling important pulpits in New York and Philadelphia, and one is a professor in one of our leading Pennsylvania Colleges. I can name a great many farmers' daughters who stand high in the medical profession, on the lecture platform, as public singers, as music teachers, as principals of schools, as nurses, as milliners, and in fact in a great many other important walks in life.

There are some country people who have an idea that magazines, books and papers and music are not intended for the inhabitants of the rural districts and consider it of no use for them to "waste" either time or money on anything but the bare articles of necessity.

Would you have your sons and daughters grow to be intelligent, refined men and women, provide them with good books; subscribe for a good magazine or two and some other papers beside the local paper, which, of course, should be in every home in the land. Teach them to sing, furnish them with a good musical instrument of some kind and have them taught how to use them.

Allow each member of the family the privilege of thinking and acting a little for himself. Give the family a holiday occasionally as well as taking one yourself. There are numerous railroad excursions which are in themselves great educators; if patronized the family will become somewhat familiar with traveling, which will be a benefit to them in after life as well as affording recreation for the present. But beware of the Sabbath excursion, which is one of the greatest evils of this fast age in which we live.

Dress yourself and family as well as your means will allow. "Clothes don't make the man" or woman, but they improve the appearance of the individual very much after he is made.

When you go to town, don't stint your wife or child in the price of a decent hat or dress in order that you may have the other 50 cents with which to lay in a stock of tobies and then wonder why she, whom you have chosen from the whole world as your helpmate, doesn't look as trig as some other women you have seen. Just think of the fact that you are sending up in smoke that which would have added materially to her appearance, and that you are also polluting the air which she of necessity must inhale as she sits or walks by your side.

And now a word to the feminine portion of the household.

When you select a hat or dress or whatever the article may be, don't choose the cheap, gaudy, high colored articles which you will find displayed conspicuously, but take a little time and select a quieter color and a better quality and have it neatly made, and when you come to wear the article you will have more respect for yourself, and other people will respect you accordingly. Few persons care to associate with a woman dressed so she resembles a walking circus bill-board. Interest yourself in what is going on around you. Pay a little attention to the birds and bees and smaller insects. You will be surprised to find how much you can learn from their habits and life, and the time will be well spent. Find out the name of the numerous plants and flowers that abound on every farm. See which are noxious and which are useful; learn their importance to the medical world and the many other things of interest about them.

But what has all this to do with "Sociability in Country Life?"

Just this; We are each one created for some mission in life, and are only able to occupy our place in society when we have improved the talents God has given us. Our moral, physical and intellectual lives must be cultivated and developed before we can expect to become important factors in society. A deeper feeling of individual responsibility is necessary to bring about a better state of society, and a better condition for the individual members of it.

How may sociability in the country be promoted?

First. Be sociable. Make your home attractive. When I say attractive, I do not mean expensively built or furnished; but make the most of the means Providence has given you, and thus you will be silently but powerfully influencing the lives of all who come in contact with it.

Don't be afraid to entertain. Invite your neighbors in to spend a part of a day and take dinner with you. You have abundance of everything that is good to eat, and in good condition with which to supply your table. To take off one's wraps and visit a few hours seems so much more satisfactory than are the short formal calls which fashion has decreed as the proper thing in town. Think of a woman making from twelve to twenty calls in a single afternoon and then terming it sociability. And the men—well, what man would care to accompany his wife on a round of this kind?

Second, be sociable. If you have friends or acquaintances in the city or large town, don't fail to invite them to spend a few days at your country home in the course of the year. It will not add materially to your labors or expenses, and will be much appreciated by those whose lives are so crowded and crushed in the bustle and whirl of the city and who perhaps never had a ride except on the street cars.

I recall a party of girls from the city who spent a few weeks at our farm house one summer when I was a girl, who said they had never enjoyed anything so much as horseback riding along the quiet country roads and in the fields and woods, and in exploring a coal mine near by, and all such simple ways which were new and instructive to them, and meanwhile they were brightening our quiet home by their presence.

Then there are city people who will enjoy a visit to the country in the winter, for sleigh riding in the city is a luxury and one has to possess a well filled purse to be able to patronize a city livery stable. The city friends will not forget your kindness but will be only too happy to invite you to visit their homes and thus afford you an opportunity to see some of the sights with which you are not familiar. Thus, in bringing happiness to them, you bring happiness to yourself.

Third, be sociable. Let the young folks have lots of picnics and boating parties, if near a stream, and sleighing parties in the winter. The ladies might meet with their work, such as sewing, knit-

ting, crocheting or fancy work; yes, and even mending, and talk while they work, thus breaking up the monotony of the quiet country life.

Fourth, be sociable. In one farming community with which I am familiar, the different families took turns in tenertaining all the other families of the neighborhood one evening each week. They had music, games and interesting selections read each evening. A plain supper or lunch was always served and the whole winter was filled with sociability and each evening was pleasanter than the preceding one. Revive the old fashioned spelling bees and reading circles, both of which are entertaining and instructive. Let the young people meet together often at your home and thus counteract the tendency of the boys to go where their morals may be corrupted, or where they may contract habits which will blast their lives for all time.

Above all, learn to be contented with your station in life. "It is the heart that makes the man rich; he is rich or poor according to that which he is, not according to what he has." Be content with enough which is "as good as a feast."

Happy would we each one be if we could say with Shakespeare's shepherd: "Sir, I am a true laborer. I earn what I wear; owe no man hate; envy no man's happiness; glad of other men's good; contented with my farm."

Place high your social standard and press steadily onward with firm tread till the Great Master shall call thee to sit down to the marriage supper of the Lamb and thou shalt hear the commendation "Well done, thou good and faithful servant."

THE INFLUENCE OF THE BEAUTIFUL IN THE HOME.

By E. ELIZABETH PATTERSON, *McConnellsburg, Pa.*

Some one has said that "Religion is to the soul what light is to nature." It might with equal truth be said that beauty is to the eye, and indeed to all our senses, what sunlight is to the flowers.

Who has not felt thrilled at the sound of exquisite music, not perhaps coming from a Handel in his grand oratorio the "Messiah," nor from a Mendelssohn in his tenderly mournful "Songs without Words," nor yet a Beethoven, Hasse or Rubinstein in their wonderfully inspiring anthems. It may be that a simple chord of music by an idly

wandering hand has touched and stirred to the depths of his being one who in years has sought only the gratification of his depraved tastes.

Longfellow has beautifully expressed this thought:

"Seated one day at the organ,
  I was weary and ill at ease;
And my fingers wandered idly
  Over the noisy keys.

I know not what I was playing,
  Nor what I was dreaming then;
But I struck one chord of music,
  Like the sound of a great amen.

I have sought, but I seek it vainly,
  That one lost chord divine;
Which came from the soul of the organ,
  And entered into mine.

It may be that death's bright angel
  Will speak in that chord again;
It may be that only in Heaven
  I shall hear that grand amen."

Words cannot tell of the good accomplished by a thought expressed, the touch of a friendly hand, the kind look from even a plain face, or some deed of goodness done, for 'tis "deeds show what we are; words show what we should be."

These things all are beautiful, just as much so as is an exquisite painting, a fine bit of sculpture, the angel face of a child—as nature itself in all her loveliness, for the "sunshine of life is made up of very little beams."

We are all created with the aesthetic, or love of the beautiful in our natures; in some this is more marked than in others; you have all seen the little child reach out its wee arms for the moon, a dainty flower, a pretty book or picture.

The beautiful things in life are the refining influences, to a great extent, and for that very reason should be developed in every possible way. It is a mistake to imagine that attention to our personal appearance is mere vanity. No more is it vanity than is the developing of intellect and character. Professor James, of Harvard, says: "Could we but realize how soon we will become mere walking bundles of habits, we would give more heed to our conduct while in the plastic state. Every smallest stroke of virtue or of vice leaves its mark. The drunken Rip Van Winkle in Jefferson's play excuses himself for every fresh drink by saying, 'I won't count this time.' Well, he may not count it, and a kind heaven may not count it, but it is being counted none the less; down in the nerve cells and fibres the molecules are counting it, registering and storing it up to be used against him when the next temptation comes."

What man is there but looks backward to his childhood and youth, and what a picture for him to carry through life in his memory, the brightest spot is his home. Possibly it has not been one of splendor. No luxuriant drawing room carpeted with Axminster, hung in rich draperies and rare old paintings, but a simple home, delightfully clean, the furnishings no matter how plain, arranged with an eye to harmony, and the contrasting of colors. And above all, the home-maker, the leading spirit in the home, with her beautiful character shining out in her face and in every little act. Dressed possibly in the cheapest of fabrics, but always neatly and tastefully, whose touch to the adornment of the home is like magic, making a little go far; whose mind stored with knowledge of the good and beautiful and true—it is she, who by her life and actions more than by words, influences her children for better or worse, and sends them out into the world with habits formed which shall last them through life.

You are all acquainted probably with the description of Mr. Peggotty's home in "David Copperfield." It was only an old, worn-out boat, with a decided suggestion of fish about it, and yet how delightful were the days "little Davy" spent there in the cozy room by the cheerful fire, with his dear friends about him. The memory of that home was one of his happiest recollections, and in after days, when sorrow and trouble came to him, as it does to all of us, he was the stronger for having known that little taste of home life.

After all, if the character be a beautiful one, so will be the face and so will be all the surroundings, for such a character will have everything in keeping with it.

A bright woman, when applauded recently for her goodness, begged her friend to let the matter drop, "for," she said, whimsically, "though I do try to be good from some really high motives, yet I have one reason which, I fear, is a low one." "What do you mean?" inquired her laughing friend. "I mean that I once heard, many years ago, that beauty after fifty depended not upon features but upon character; like all women, I desired to be beautiful, and as Providence had denied me the features necessary to secure that result in early life, I determined to make the attempt to be beautiful at 50. I am now 35," she concluded merrily, "and I must confess that I see no signs of this Indian summer loveliness, but I still try to be good." These friends treated this matter as a jest, but there is really sense and truth in the saying that beauty in later life, in either man or woman, is dependant upon character far more than upon form or color, and it might be observed that this is oftenest true of women of high character.

If in early life all were taught to appreciate the beautiful in everything, the refining influence of the home would be more widely felt and consequently the moral standard would be a higher one.

It is the children of homes wherein the beautiful has but a small

place, where discord is to be felt in the very atmosphere, where the patient training of the intellect, the heart and the character is never felt, where harmony in every shape and form is missing—it is the children of such homes that grow into men and women to be feared, who form and support every institution of vice, and who hold an equal right to citizenship and the forming of our laws.

Many a man would be saved from the gambling den, the rum shop, and other equally degrading influences and habits if stored away in his heart was the memory of a beautiful home, a refined and lovely mother (refinement may belong to the humblest of us), and a father strong in the upholding of noble principles. These, I say, are the links that form a chain, the strength of which will resist the temptations in life. These are the influences which will cause us to seek the beautiful in all things, the best this world can give. We will grow into stronger, purer, more beautiful men and women, the voyage to the better life will be one fraught with but few dangers, and the closing of such a life will indeed be a benediction.

May the influence of the beautiful in our homes and our lives lead us onward and upward; may we spend our lives and deem them well spent in the love of our homes, our country and our God!

KITCHEN GARDENING.

By MRS. ALICE H. SIGGINS, *West Hickory, Pa.*

The first consideration is a suitable location for your garden. If the ground is not naturally dry it must be drained, then properly fertilized. The most successful gardens we have had have been the results of fall plowing, followed by an early spring plowing, which gave the frost a chance to pulverize the ground more thoroughly than spring plowing alone could do. And by this means many injurious insects are brought to the surface and destroyed by the frosts.

The next thing in order, if possible, is to have a good seed drill and wheel hoe, as these will enable one to accomplish twice the amount of work in a given time that he could do with the old methods. Nearly all of the garden vegetables can be put in with the drill, about all can be worked with the wheel hoe. For this work we use the Planet Junior drill and hoe.

One must know the most profitable things to plant and acquaint

himself with the best varieties. He must be able to take advantage of the most improved vegetables.

But you must not ruin your gardens by constantly experimenting with things advertised by men who are anxious to make money at your expense. The United States Government has now over fifty experiment stations, which do all the scientific experiment work of agriculture that can be required by a people. They are in reach of ever farmer who will ask for information concerning progress or improvement. One of the best helps published is Bulletin No. 15, entitled "Handbook of Experiment Station Work," which you can obtain, free of charge, by addressing the United States Department of Agriculture, Washington, D. C. It will be found to be of great value to farmers, stock raisers and gardeners.

The first seeds to go into the ground are the peas, early and late, and they may be planted as soon as the ground is sufficiently dry. If sown quite early, care must be taken to have them well covered.

Onions may be set about this time. Some of the newer varieties are more attractive and seem to be more palatable and productive.

A few rows of potatoes should be put in early and they will require a deeper covering than would be necessary later in the season. They may be Early Rose, Beauty of Hebron or Early Ohio, or any of half a dozen other good varieties. I read somewhere that a Rhode Island gardener had cut tubers into four pieces, lengthwise, and, after giving them plenty of fertilizer, wrapped each piece in a newspaper and set it endwise in a box of earth. They were then put in a warm place, where growth soon started and they were set out in three weeks, with roots well under way, and the new crop was gotten more than two weeks earlier by this treatment. About the middle of last April, we had the sprouts rubbed from potatoes which had been wintered in a cellar, and placed in a hole which was dug in a dry place, three feet deep, and lined with straw. The potatoes were put in twelve inches deep, boards were laid on top and earth was thrown in to the level of the ground. Two or three weeks before new potatoes were ready to be used this hole was opened and a portion taken out. It was found the sprouts had not started again and they were of an excellent quality. They were used in preference to the new potatoes, even after they were ready for the table.

As soon as the hard frosts are over, early varieties of cabbage may be set out, and intermediate cabbages may be planted until the last of June. Cauliflowers are put out at this time, early varieties first. By some means, this valuable vegetable has been neglected in this section. The general impression is that it is harder to raise than cabbage. We have not found it so. Last season we grew them under all circumstances; even when neglected, they made fine heads. After quite a heavy frost last fall, we gathered lovely white heads from

our garden. This vegetable, when properly prepared, is a delicacy, and for picking it has no equal.

Last year we planted two rows of 100-foot lengths of Golden Wax beans. The production was surprising. A great many were taken off for table use. Two bushels were dried. The pods, being split in two, lengthwise, and boiled in strong salt water, were put near a stove until sufficiently dry to be stored away in paper bags for winter's use. When carefully prepared, these will be found to form a very appetizing dish.

Tomato seed should be started in boxes in the house about the first week of March, and when three or four weeks old, transplanted into pots holding a single plant. When all danger of frost is over, set in the garden, in that part of it, too, in which the very richest soil abounds. Always put out twice the number you expect to be required of these plants, as, in this way, you will be enabled to have tomatoes for table use two or three weeks earlier, as a few specimens of each stock will ripen much earlier than the majority, and, on the other hand, one is not compelled to use any but the very choicest fruits.

Celery is a plant that has almost universal use. The mode of culture is well known. The so-called self-blanching celery has not given general satisfaction.

Corn, squash, turnips, carrots, cucumbers and the like must not be neglected and the cellars will be well stored in the fall time with the best a season can afford.

Patches of raspberries—black and red—strawberries, a few currant and some gooseberry bushes must all be remembered. Make your gardens beautiful, and you will like to be in them. The most successful gardener of last year will have the cleanest garden this year. Read good farm literature and you will want to progress with the times.

The products from the kitchen garden and farm, with a very little outside assistance, will enable a housewife to set a table at which a king might sit, and to his complete satisfaction, too.

MISCELLANEOUS PAPERS.

By DR. B. H. WARREN, *Economic Zoologist*.

RAVENS, CROWS, JAYS AND SHRIKES.

Five species of the family Corvidae are found in Pennsylvania, and of these the Common Crow and Blue Jay are by far the best known. Indeed, probably no two representatives of our bird-fauna are more familiar to persons who are at all acquainted with rural life than are the gaudy, garrulous Blue Jay, and his suspicious, pilfering relative, the Common Crow.

THE RAVEN.

The Northern Raven is a sub-species, that was first recognized and described by my friend Prof. Robert Ridgway, the eminent ornithologist of the Smithsonian Institute, Washington, D. C. This bird possesses peculiarities which entitle it to be particularized by the technical specific principalis to distinguish the new form from that of its near kin the Common Raven (*Corvus Corax*), of the older authorities. It ranges from "Greenland to Alaska, south to British Columbia, Canada, New Brunswick" and Pennsylvania. In this State it is found as a resident in a number of counties, particularly such as are mountainous and which contain large areas of sparsely settled and extensively wooded lands.

The Raven is very shy yet occasionally he will come around farm buildings, in the neighborhood of his favorite haunts in the mountain wilds, to catch young poultry or hunt a hen's nest, especially that of the turkey which so often wanders some distance from her owner's buildings to hatch. The damage, however, to domesticated fowls by Ravens in Pennsylvania is, I am sure, very insignificant.

From evidence in my possession, I am fully convinced that Ravens, like their dark-coated relations, the Crows, do devour the eggs and young of many wild birds. Game birds such as the Ruffed Grouse, and Wild Turkey, woodsmen say, suffer considerably during the

periods when they have eggs and broods of young, from sly and unexpected visits which these cunning and able-bodied corvine birds pay them. If a Turkey or Pheasant with her children, remains in the locality and the fact becomes known to a pair of Ravens, the chances are, hunters say, that the Ravens will watch the place almost constantly, day after day, until they have destroyed or driven away the mother and her family of youngsters.

Ravens unquestionably kill a good many young hares and they also sometimes attack and overpower the old ones, particularly when the latter are enfeebled by disease or are wounded by human hunters or other animals which prey on them. Rabbits and Pheasants entrapped in snares (which, by the way, cannot be legally used in Pennsylvania), if found by the sharp-eyed raven, will be attacked and eaten by him after he has convinced himself that the mammal or bird, suspended from the cord or fine copper wire, has not been placed there as a lure to his own destruction. In this State, Ravens are generally seen singly or in pairs or occasionally a pair with their family of inquisitive and noisy children, of the year, may be observed together.

I have known two or three pairs of Ravens to remain for two or three years in the same locality, i. e., in a district of perhaps five or six miles square, and each pair of birds, as well as the young ones, appeared to evince no disposition to be on intimate relations with their neighbors. Of course, the whole raven clan, no doubt, had a speaking acquaintance, because their hoarse voices could always be heard when they came within hailing distance, as was often the case, while out on foraging excursions.

Ravens, like the Common Crow, will sometimes attack young lambs and peck out their eyes. It is also asserted by hunters that these birds have been known to attack very young fawns when their watchful mothers were not near at hand.

I have been told by old hunters and woodsmen, that twenty-five or thirty years ago when the Virginia Deer was abundant in many sections of Pennsylvania, that Ravens were then rather numerous in the romantic wilds since made barren through the woodsmen's axe and devastating forest fires. In those days farmers who resided in the vicinage of virgin-timbered areas in the mountainous districts suffered considerably from visits of the spying, argus-eyed Ravens which seemed ever on the alert to pounce down from some carefully chosen hiding place and rob the turkey or the chicken of her eggs or brood. Then if the parent sheep did not keep a very close guard over their young offspring the omnivorous and flesh-loving Ravens would attack and kill them; they also, it is affirmed, were known to pounce upon, in at least two instances within the recollection of aged mountaineers, calves but a few days old; and on another occasion, one of my informants states that a band of hungry nomadic Ravens at-

tempted to make a meal on an old sow's litter of pigs that were only a few days old, and so persistent were their onslaughts that the owner of the pigs was compelled to shoot two of the Ravens before they would leave the place.

Deer enfeebled by old age or reduced from disease, and also when wounded by human huntsmen, panthers, wolves, wild-cats or other predatory animals which possessed sufficient courage and prowess to attack them, at times were beset by Ravens which would pick out their eyes and other soft parts, particularly portions of the poor deer's anatomy that had been opened by a bullet or with teeth or claws of some cruel carnivorous beast.

These observations showing the fierce and sanguinary nature of Ravens which, with labored but quick flight, and harsh cries, over a quarter of a century ago, are reputed to have brought so much misery into the happy homes of many of their neighbors—co-dwellers in the mountain wilds—I cannot confirm from personal observations in the field in recent years or since Ravens have become very much less numerous.

The statements, however, come from sources which I deem thoroughly trustworthy. They are here recorded, substantially as given to me by aged informants, men whose vocations of hunting, trapping, woodchopping or bark peeling, compelled to live almost continually the year 'round, in dense forests, and other wild, uninhabited places. These places, however, were ideal localities for a careful observer to learn the life histories of wild animals which the wise Maker designed should find suitable abodes in dark sylvan shades or along the banks of the cool, healthful waters of mountain streams, and by rocky and mountainous pathways, vestiges of which still remain in many regions of the Keystone Commonwealth, as if to remind us of the bloody struggles that our ancestors a century or two ago were so often forced to engage in with the Indians who made these "trails."

From the fact that I have often observed different kinds of small birds, which build their summer homes in regions selected by the croaking raven for his abiding place at all seasons of the year, always show great concern wherever a solitary Raven, or worse still, a pair of them, came near their nest or young, it is safe to infer that the solicitude they manifested was due to a knowledge obtained, perhaps, by bitter experience, that, if the Mephistophelean-like eyes of the powerful marauder, attired in his funeral coat, discovered their precious treasures they would soon be "gobbled up" to help supply Mr. Raven's gastronomic needs, which are great, and likewise most varying, as is the case with all omnivorous animals.

The Raven will consume annually a good many insects, particularly the numerous ground-inhabiting and wood-destroying beetles, crickets, grasshoppers and "grub worms" he eats with great gusto.

Beetles and grubs he generally finds about old stumps and dead

logs. On two occasions I have seen Ravens, like the Common Crow, hunting in newly plowed ground for larvae, beetles, and mice. They feed on different kinds of small mammals, besides young hares, as previously mentioned; and they have been known to attack and kill flying squirrels and chipmunks, but their usual articles of food in the line of mammalian life are the different species of mice which abound in the woods and fields.

Ravens will eat, with great relish, different kinds of berries which grow wild, and often in great abundance, in the mountainous districts. Cherry, peach and apple trees, which are not uncommon in many wild mountainous places remote from human habitation, are often visited by Ravens to feed on the ripe or ripening fruit. In the autumn and winter season, like the Ruffed Grouse, Ravens may be seen at times hunting about apple trees for the seeds of the fruit which they collect from the ground or by picking into the rotten and frozen apples which hang on the twigs; and, like their saucy relatives, the Jays, dressed in jaunty plumed hats, white vests and bright blue coats, they get chestnuts, beechnuts, acorns and other seeds known as "mast." They catch frogs and sometimes kill and devour small sized snakes. They will go in shallow water to catch fishes which they consume. Most flesh eating animals, either birds or quadrupeds, which obtain their livelihood by open warfare, do not show an inclination to feed upon carrion and offal unless compelled to do so by reason of the scarcity of normal food supplies.

The Raven, however, has the habit of subsisting, in part at least, on such a menu, even when other food could be obtained with the usual cunning and activity displayed by this race of pilferers. Of this I was fully convinced some three years ago when visiting at Glen Union, Clinton county, Pa., where two or three families of Ravens had their headquarters in rocky cliffs, about three miles in the interior. At irregular intervals some of the meddlesome tribe would come down to the dwellings, along the Susquehanna river, and steal a young chicken or rob a hen's nest; and, on one occasion, I noticed two of them in a vine, along a road near the railroad station (Glen Union), eating "frost" or chicken grapes, a common article of diet, by the way, for the Pheasant or Ruffed Grouse. These Ravens daily came to the places where the woodsmen ate their dinners and fed the horses, and in a short time after being allowed to pick up, unmolested, pieces of bread and meat about the camp, they became quite tame, unless they saw a stranger appear about the place, when they flew off in apparently great anger. By some accident a horse was killed and its body hurled into a deep ravine. By this mishap I learned that Ravens were very partial to horse flesh as they daily visited the decaying carcass and seemingly made little or no efforts to obtain other kinds of food.

When deer are shot and eviscerated, Ravens will come around and

feed on the refuse matter. At such times they generally are seen in pairs but sometimes several are together.

THE FISH CROW.

The Fish Crow, smaller than the Common Crow, glossy back with green and violet reflections, occurs chiefly about maritime districts of the Atlantic coast, from Long Island to Florida. In Pennsylvania the Fish Crow is found, in the summer season, along the shores of the Delaware river and about the Susquehanna river from Columbia, Lancaster county, southward. The Fish Crow has the same bad habit which has made such a blot on the good name of its near kinsman, the Common Crow, namely, that of robbing, Audubon tells us, other birds of their eggs and young. However, such deeds of rapine, on the part of the Fish Crow, are, it is believed, much less frequent than is the case with the Common Crow.

Some observers, however, assert that Meadowlarks, Clapper Rails, Terns, Quails and other small species of birds suffer the loss of many of their eggs and young through the thieving propensities of Fish Crows which are common about the sea coast regions.

THE COMMON CROW.

This well known species is common during all seasons of the year, in Pennsylvania. At times, other than when breeding, these birds are gregarious and often collect in large flocks. Dr. C. Hart Merriam, Chief of the Biological Division of the U. S. Department of Agriculture, Washington, D. C., in briefly summarizing the food habits of the Crow, in a letter of transmittal that appears in Bulletin No. 6, prepared by his assistants, Messrs. W. B. Barrows and E. A. Schwarz, whose exhaustive report, entitled "The Common Crow of the United States," is based on nearly a thousand stomach examinations of Crows taken during all seasons, and careful field notes, says:

"The most important charges brought against the Crow are: (1) That it pulls sprouting corn; (2) that it injures corn in the milk; (3) that it destroys cultivated fruit; and (4) that it feeds on the eggs and young of poultry and wild birds.

"All of these charges are sustained by the stomach examinations, so far as the simple fact that Crows feed upon the substances named. But the extent of the injury is a very different matter.

"In order to ascertain whether the sum of the harm done outweighs the sum of the good, or the contrary, the different kinds of food found in the stomach have been reduced to quantitative percentages and contrasted. The total quantity of corn eaten during the entire year amounts to 25 per cent. of the food of an adult Crow, and only 9.3 per cent. of the food of the young Crows. Leaving the young out of consideration it may be said that in agricultural districts about one-fourth of the

food of Crows consists of corn. But less than 14 per cent. of this corn, and only 3 per cent. of the total food of the Crow, consists of sprouting corn and corn in the milk; the remaining 86 per cent. of the corn, or 97 per cent. of the total food, is chiefly waste grain picked up here and there, mainly in winter, and is of no economic value.

"In the case of cultivated fruits the loss is trivial. The same is true of the eggs and young of poultry and wild birds, the total for the year amounting to only one per cent. of the food.

"As an offset to his bad habits, the Crow is to be credited with the good done in destroying noxious insects and other injurious animals. Insects form 26 per cent. of the entire food, and the great majority of these are grasshoppers, May beetles, cutworms and other injurious kinds. It is shown that during the May beetle season, in May and June, these beetles form the principal insect food of the Crow. Only a few stomachs do not contain them, and stomachs are often filled with them. The fact that the May beetle season coincides with the breeding season of the Crow is of special importance, the principal food of nestling Crows consisting of these beetles."

Mr. Schwarz also finds that grasshoppers occur in the stomach throughout the year; during May beetle season they occur in the vast majority of stomachs, but usually in moderate numbers; that with the disappearance of May beetles towards the end of June, they increase in numbers until in August and throughout the fall they constitute by far the greater part of insect food, often occurring in astonishing numbers, often forming the only insect food.

"To the same side of the scale must be added the destruction of mice, rabbits, and other injurious rodents by the Crow.

"In summing up the benefits and losses resulting from the habits of this bird, it is clear that the good exceeds the bad and that the Crow is a friend rather than an enemy of the farmer."

During the months of July and August, 1896, when the writer was engaged in studying the Army Worm, which preyed upon cereals (particularly oats), grass, etc., in this State to the extent probably of $300,000 (estimated), abundant opportunity was afforded to learn what species of birds and other animals subsisted on the voracious larvae.

While conducting these investigations, in different parts of Pennsylvania, several hundred birds of various species were shot and examined. These post-mortem examinations, as well as observations in the field, demonstrated conclusively that Crows and Crow Blackbirds were, perhaps, the most useful of all birds in devouring army worms.

The viscera of twenty-three Crows, old and young, which were captured in different counties of the State, and in localities where army worms were abundant, were in many instances, found to be gorged with the remains of these larvae. Crows also ate large numbers of

the pupae. I noticed Crows or Crow Blackbirds, especially the Common Crow Blackbird, to be quite numerous in nearly all fields where the crawling hosts were abundant, and these dark-colored and badly abused birds, by their constant warfare on the worms, did much to keep in check the damage to cereal and other crops. Crows were generally to be observed singly or in pairs, sometimes in parties, five or seven individuals, but the Blackbirds were often noticed in good sized flocks. One flock of Blackbirds numbered fully seventy-five individuals and they all seemed to be intently engaged for a considerable time in the morning or evening, as well as at intervals in midday, destroying the Army Worm. A Crow would eat a handful of the worms at a single meal; the number which a single bird would devour in a day was immense.

Several farmers whose premises I visited when investigating the ravages of the Army Worm expressed great surprise when they were informed that Crows and Blackbirds fed almost wholly on the voracious insect-pests which were devastating the oats, barley, corn and grass fields. When specimens of these birds were shot and the contents of their stomachs exposed, they admitted that the birds were not as bad as it was commonly supposed.

The Crow's fondness for eggs and young of domesticated fowls as well as his penchant for despoiling the nests of numerous wild birds of their eggs and young is well known; then again the Crow visits the cornfield in the springtime and in the Autumn he often does considerable damage. These carnivorous taste and grain eating habits of the Crow have caused, it seems, a great many of our farmers to place Mr. Crow under ban.

The Crow Blackbird, like the Common Crow, destroys the eggs and young of different species of beneficial birds which nest in orchards, parks and gardens, and he also often, like the Crow, visits the cornfield or cherry tree. However, if farmers would take the trouble in the spring when Crows and their bright-eyed relatives, the Blackbirds, are at work in the cornfields to carefully investigate they would find no doubt, as the writer had, that these birds are not there for the purpose of destroying corn but to save it from crawling foes which hide beneath the soil.

Reader, if you doubt the statement, take the trouble, sometime in the spring, when the corn is an inch or two above the ground, to shoot some of the birds, open their stomachs, and the chances are ten to one you will discover that these "corn pulling" birds have nothing but "cutworms," other larvae and beetles in their food receptacles.

The Crow, undoubtedly, at times, particularly in the fall when the farmer is slow about taking corn in from a field, sometimes does considerable damage. In the spring this bird also occasionally does a good deal of mischief in corn fields. This same statement may likewise be made concerning the Blackbird. However, notwithstanding

the fact that both species of birds just mentioned destroy more or less corn, the great amount of good they do by destroying innumerable insect foes which prey, constantly during the summer season, on grain, fruit and garden crops, is, according to my judgment, considerably in excess of losses incurred from casual predatory visits which these omnivorous birds make to the growing or ripened corn.

If it was not for the bad habit which the Crow has of destroying eggs and young of both poultry and wild birds, and the same is true of the Crow Blackbird which has acquired quite an appetite for eggs and nestlings of different species of small wild birds, there could be no possible reason for doubt in the mind of any naturalist about both of these well known species being far more beneficial than harmful to the farmer and fruit grower. Sportsmen also view the Crow and Blackbird, especially the former, in an unfavorable light, because they will often destroy the eggs and sometimes the young of game birds, grouse and quail, meadowlarks, etc. Along the saltwater marshes of the Atlantic ocean, when collecting specimens with my genial and gifted friend, the naturalist, Mr. C. M. Busch, we have observed Crows pillaging the nests of Terns and Mudhens, or Clapper Rails, as ornithologists call them.

THE JAYS.

Two species of Jays—that is, feathered Jays—included in the subfamily Garrulinae, are attributed to the fauna of Pennsylvania.

One of these, Canadian Jay, a native of the distant north, is seldom found as far south as this State where it has only been taken as a rare straggler in winter.

THE BLUE JAYS.

This bird of bright color, saucy, independent ways and mimicking voice, is common and well known to every farmer's boy, woodsman and hunter. While all admire him, because of his showy coat and cunning habits, he is, nevertheless, very generally regarded with disfavor because of his mischievous traits of character.

Blue Jays, like some school boys, seem to go out of their way to hunt trouble, and they usually find it, but often not until they have caused a good deal of bother or suffering to others about them.

The Blue Jay has an extensive range, being found over the whole of the United States east of the Great Plains, from the warm climate of the Gulf of Mexico northward to the dreary wilds of the Fur countries.

In Pennsylvania, and, it is said, in most parts of their range, they remain throughout all seasons of the year. These beautiful birds commonly resort to forests to breed, yet they do not live like hermits in the woods, for when searching for food they frequently come about

orchards, gardens, meadows and farm buildings. In the cold winter season when the ground is covered with snow these birds will visit the farmer's corn cribs, like the Crow Blackbird and Redheaded Woodpecker, peck at corn which can be reached from the outside through the slats.

Jays when breeding commonly are seen in pairs, but in the late summer and fall it is not unusual to find them in small flocks; on different occasions I have seen twenty or twenty-five of them feeding in beech, chestnut or apple trees. Blue Jays, as is the habit of other members of their family, will feed on different cereals, but of all the grains, corn or maize is the one most preferred. A pair of Jays will pilot their young ones, when able to fly, to a corn field to feed, and sometimes a good sized flock of these sprightly birds may be observed at work in a corn field, particularly if located along the edge of a dense woods.

Mr. F. E. L. Beal, Biologist, U. S. Department of Agriculture, has recently prepared and published a very interesting and valuable paper on "The Blue Jay and its Food." This paper, based on about 300 examinations of "stomachs collected in every month of the year from 22 states, the District of Columbia and Canada," places the Jay in a most favorable light.

The most striking point in the food of the Blue Jay is the discrepancy between the testimony of field observers concerning the bird's nest robbing proclivities and the result of stomach examinations. The accusation of eating eggs and young birds are certainly not sustained, and it is futile to attempt to reconcile the conflicting statements on this point, which must be left until more accurate observations have been made. In destroying insects the Jay undoubtedly does much good. Most of the predacious beetles which it eats do not feed on other insects to any great extent. On the other hand, it destroys some grasshoppers and caterpillars and many noxious beetles, such as *Scarabaeids*, click beetles (*Elaterids*), weevils (*Curculionidis*), *Buprestids*, *Chrysomelids* and *Tenebrionids*.

The Blue Jay obtains its fruit from nature's orchard and vineyard, not from man's; corn is the only vegetable food from which the farmer suffers any loss and here the damage is small. In fact, the examination of nearly 300 stomachs shows that the Blue Jay does far more good than harm.

The field observations of Audubon, made many years ago, prompted this great naturalist and truthful authority to write in the following words of the manner in which Jays delight to kill birds and pillage the nests of pigeons and domesticated fowls:

"It robs every nest it can find, sucks the eggs like the Crow, or tears to pieces and devours the young birds. A friend once wounded a Ruffed Grouse, and marked the direction which it followed, but had not proceeded two hundred yards in pursuit, when he heard something fluttering in the bushes, and found his bird belabored by the Blue Jays who were picking out its eyes. The same person

once put a Flying Squirrel into the cage of one of these birds, merely to preserve it for one night; but on looking into the cage about eleven o'clock the next day he found the mammal partly eaten.

"A Blue Jay at Charleston destroyed all the birds of an aviary. One after another had been killed, and the rats were supposed to have been the culprits, but no crevice could be seen large enough to admit one. Then the mice were accused and war was waged against them, but still the birds continued to be killed; first the smaller, then the larger, until at length the Key West Pigeons; when it was discovered that a Jay which had ben raised in the aviary was the depredator. He was taken out and placed in a cage, with a quantity of corn, flour and several small birds which he had just killed. The birds he soon devoured, but the corn and flour he would not condescend to eat, and refusing every other kind of food, soon died.

"In the north it is fond of ripe chestnuts, and in visiting the trees is sure to select the choicest. When these fail it attacks beech nuts, acorns, peas, apples, and green corn. In Louisiana they are so abundant as to prove a nuisance to the farmers, picking the newly-planted corn, the peas and the sweet potatoes, attacking every fruit tree, and even destroying the eggs of pigeons and domestic fowls."

It is no unusual sight, in the summer time, to see a Jay quietly slip from tree to tree in a woods and starting from the lower limbs of each tree he performs a cork screw like inspection tour around the trunk and along the limbs until he has inspected the whole tree, then he flits to another leafy retreat to look for eggs or young birds, or perhaps some observers may say, on such occasions, he is only looking for beetles, caterpillars, "bugs," wasps or flies. Of course, Mr. Jay would, doubtless, when on these foraging excursions, pick up such forms of insect life which please his palate, but my belief is that at these times he is bent on mischief and wants eggs or nestlings. This same belief, it seems, is shared by tanagers, orioles, flycatchers, warblers and others of the beneficial feathered kind which build their fragile summer domiciles in trees, for as soon as a meddlesome Jay comes around, the other birds show great agitation and promptly proceed to give him battle.

Possibly some observers believe insect devouring forest birds, such as the Scarlet Tanager, Red Eyed Vireo, the numerous kinds of warblers, and other sweet-voiced songsters, which make war on the Jay that comes about their homes, do so because they are prompted by jealousy and fear the unwelcome visitor, attired in his showy coat of blue, with whitish waistcoat, black cravat, and high, peaked hat, will catch too many palatable insects around their dwelling places. From careful field observations of fully twenty-five years, I am strongly of the opinion that these gaudily dressed and saucy inquisitive Jays make stealthy raids in trees, etc., with murderous designs in their hearts, and of this the other birds are well aware, hence their cries of distress and defensive actions in order to save from ruin their fragile eggs and half-fledged young.

These several species of tree-inhabiting and insect devouring birds, previously referred to, certainly are not prompted by the Jay's supe-

rior size to give him battle when he visits their domiciles. If they are why is it that they do not pitch into the Turkey Vulture which often comes in their midst? It is, kind reader, because years of experience has proven that the Jay, like some members of the genus homo, arrayed in a fine dress and with insinuating ways, is a despoiler of homes, while, on the other hand, the life of the Turkey Buzzard is one of honesty, though extremely disgusting and filthy.

The Jays, like other birds of the family, are omnivorous in their food habits. They consume much vegetable food, such as cereals, mast, berries and fruits; their animal food comprises numerous insects and their larvae, with spiders, snails, lizards, tree frogs, mice, birds and eggs. Considerable mineral matter, sand, gravel, etc., is often found in their stomachs.

SHRIKES OR BUTCHER-BIRDS.

Two species and one "geographical race" of shrikes are found in Pennsylvania. The name of the Butcher-bird is applied to these birds because of the habit they have of impaling prey—insects, mice, small birds, etc.—on thorns or sharp projecting twigs of bushes or trees. The insects, mice or birds, which they catch and impale were supposed, by some old writers, to resemble the wares of the butcher on the market shambles, hence the name.

THE NORTHERN SHRIKE.

This species, the largest of the three Shrikes occurring in Pennsylvania, is found with us only as a winter sojourner. During its residence in this region from November to April, it frequents briery thickets, thorn hedges, and grassy fields near trees and shrubbery. The Northern Shrike breeds beyond the Northern United States. This bird as well as the species called Loggerhead Shrike, and its very intimate relation (specimens of which are so nearly alike the typical loggerhead that experts are unable at times to distinguish the "race" from the species), the "geographical race," styled in common ornithological parlance, the White Rumped Shrike, are known in some sections of our State as the little "Gray Hawk."

This name is highly inappropriate. Shrikes are not related to the Hawks. The name, however, is given by farmers and gunners, who see these birds catch small birds, mice, etc. During recent years, or since the English Sparrow, our imported bird nuisance, has become so alarmingly abundant in the cities and towns, Shrikes—particularly the Northern Shrike—have learned to visit lawns, parks and gardens, and ivy-covered buildings, to prey on these passerine pests, which before many years will become a serious menace to our farmers and pomologists.

This sparrow-devouring habit which the Shrike has developed in

recent years, has, fortunately, won for him the good will of many, who, in former years, through ignorance, destroyed this bird, because it was alleged, and generally believed that the Shrike preyed on domesticated fowls.

The poor Shrike, which gains a livelihood principally by catching destructive beetles, grasshoppers and mice, was placed on the black-list by farmers and poultry raisers, who, because of insufficient knowledge, mistook this gray-coated benefactor, when he came about their premises to devour insidious foes, for either the Cooper's Sharp-Shinned or Pigeon hawks, all of which destroy poultry, and numerous kinds of wild birds.

THE LOGGERHEAD SHRIKE.

This bird is noticeably smaller than its cousin, the Northern Shrike, which is so named because it rears its young in boreal regions where at the close of the fleeting arctic summer it is compelled, with its progeny, to migrate southward where it can find a sufficient supply of desirable food.

The Loggerhead is a common summer bird in many parts of Pennsylvania, particularly in the northwestern end of the State in the vicinity of Lake Erie, a short distance from the busy city of Erie.

This species feeds chiefly on insects, particularly grasshoppers and ground-inhabiting beetles. They destroy a good many May beetles, mice, and some birds. Occasionally they kill, I have been told, English Sparrows; but their attack on sparrows and other small birds are much less frequent than is the case with the Great Northern Shrike.

I have on two or three occasions been informed by farmers that Butcher-birds (said to be the Loggerhead species) had been seen to make attempts to catch young chickens but a few days old. It is, however, a rare thing for one of these birds to make an attack on young chickens, as, I think, it can be stated, with absolute safety, that all the Shrikes that have been in Pennsylvania during the past ten years have not committed depredations in the poultry yards which would amount to five dollars.

THE SKUNK.

Mephitis Mephitica.

DESCRIPTION.

A heavily-built animal, about the size of the house cat, although its body is shorter and more bulky; weighs about eight pounds, its legs are short, ears low, eyes brown, with a long, bushy tail. Color black (some examples maroon and white). The white markings vary greatly in extent and detail; some examples of the genus have a small white spot only, but the common pattern has narrow white frontal (head) stripe, a broad nuchal (neck), white patch, from which diverge on either side of back, and extend to or near the two stripes of white. The tail may be black, but oftener it is marked with white, especially terminally.

HABITAT.—This species, including its varieties or sub-species, occurs generally throughout North America.

This familiar animal generally hides in some dark retreat during the daylight although occasionally on cloudy days he is seen abroad and he also hunts in the twilight. The species technically known as *Mephitica*, and a form or sub-species called the Carolinian Skunk, *Mephitis Mephitica Elongata*, as defined by Mr. Bangs, with perhaps other sub-species, are in Pennsylvania, where many thousands of these animals are annually killed for the fur trade. Indeed, the long and heavy coat of this mammal is so valuable in the fur markets that skunk farms are conducted on an extensive and profitable basis in New York, Ohio and other states. The skunk, in different shades of dress, which for the purposes of this article it is not necessary at this time to discuss, is one of the common mammals of our State.

Many persons know the animal by the name of Polecat, a term applied to a small, brownish-black, ferret like creature—a member of the Weasel group—which inhabits the temperate zone of Europe and Asia. The common domesticated ferret, so frequently employed to hunt rabbits and rats, is, it is believed, a descendant of the Polecat of the old world. Some furriers sell skunks—those lacking the white stripes on backs—under the name "Alaska Sable," and many ladies wear these pelts and never know they once covered the backs of vile smelling and insect-devouring animals of the genus *Mephitis*.

This well known quadruped, it matters but little whether called Canadian Skunk, Carolinian Skunk, Polecat or "Alaska Sable," has numerous enemies to contend with, notwithstanding the wise provision nature has made to enable it to prevent their near and dangerous approach. The Skunk has great confidence in its battery and

is often enabled, when acting on the defensive, or, if aroused by either anger or fright, to protect its life from preying animals, by discharging from the annal glands a yellowish fluid of most penetrating and sickening odor. This, however, is not always the case, and the slow moving Skunk often becomes a victim of its own temerity, inspired, doubtless, by too much confidence in the repelling powers of the contents of its perfume reservoirs.

Among the carnivorous mammals, the Wild Cat, Red Fox, Mink and Weasel, will attack and kill Skunks. Large Hawks, particularly the Red-tailed species and the powerful Goshawk, also capture them. The Snowy Owl, when pressed by hunger, will, it is stated, sometimes make a meal on the Skunk which happens to cross its path; and the Great Horned Owl often attacks Skunks. On two occasions I have known that remains of recently killed Skunks were discovered in nests occupied by Great Horned Owls; and at different times I have secured Owls of this species which were so strongly scented with odor that there was no room to question what they had been feeding upon or meddling with. Mr. Thomas H. Jackson, of West Chester, Pa., writing in the "Ornithologist and Oologist," June, 1886, says:

"Great Horned Owls are liberal providers for their young. I have frequently found full grown Rabbits lying in the nest beside the young, and scarcely a nest visited which did not have a strong odor of Skunk, while bones and feathers were scattered around attesting to the predacious habits of the proprietors."

Chief among all its enemies which the poor and well disposed *Mephitis* has to guard against is man, who should often protect rather than persecute this animal.

Of all our mammals this species is probably the most useful to the farmer and fruit grower. The insect eating habits of this nocturnal prowler are so generally known to the farmers of the hop growing districts of the Empire state that local laws have been enacted for the protection of the much abused and persecuted Skunks, which Dr. C. Hart Merriam very truly says, is

"Pre-eminently an insect eater; he destroys more beetles, grasshoppers and the like than all our other mammals together, and in addition to these devours vast numbers of mice."

From numerous reports received at the Department of Agriculture from farmers, poulterers and sportsmen in Pennsylvania it is quite evident that the odoriferous Skunk is not regarded with much favor; in fact, but a small number of our correspondents appear to know that he possesses any especial inclination to eat insects and destructive larvae. The general impression seems to be that this animal reaches the acme of bliss when he can gain an entrance to a hen coop and devour chickens or suck eggs; and it matters but little how old the latter may be.

A number of sportsmen who spend considerable time every year in the woods and fields give the Skunk a record blacker than the pelt of the most marketable Polecat.

With few exceptions the testimony from sportsmen is that the main thing the Skunk lives for in this region is to devour the eggs of Grouse, Quail and other birds which nest on or close to the ground. Such opinions concerning the Skunk are wrong, yet they are, unfortunately, quite generally entertained by a large class of our citizens who become unjustly prejudiced against this useful animal and destroy him and his family, when in reality these animals are of great benefit on the farm where detrimental insects and sleek-coated rodents are almost continually at work preying on the crops.

Concerning the food habits of the Skunk, Dr. C. Hart Merriam, of Washington, D. C., a gentleman who is universally regarded as one of the most eminent and reliable economic zoologists in America, says:

"He preys upon mice, salamanders, frogs and the eggs of birds that nest on, or within reach of the ground.

"At times he eats carrion, and if he chances to stumble upon a hen's nest the eggs are liable to suffer; and once in a while he acquires the evil habits of robbing a hen-roost. Still, as a rule, Skunks are not addicted to this vice, and it is with them very much as it is with dogs and cats; for every now and then a dog will get into the habit of killing sheep, and a cat of killing chickens and sucking eggs, and yet we do not wage a warfare of extermination against them, collectively, on account of the sins of a few of their number.

"He is of the greatest practical value to the hop-grower, for he frequents the hop yard with great regularity, and greedily devours the insect pests that, from their numbers and destructiveness, always injure, and sometimes ruin the crop.

"Indeed, the benefit that accrues to the farmers from the occupancy of his premises by a family of these useful animals can hardly be over-estimated. They are large eaters and subsist almost exclusively upon his greatest enemies, mice and insects.

"Of the truth of this assertion he may easily convince himself by merely taking the trouble to examine any bit of 'Skunk sign' that he may happen to come across; for in the summer season, their dejections consist wholly of the indigestible chitenous coverings of beetles, grasshoppers and other insects."*

These statements from the facile pen of the genial and able Merriam, together with such information as any one can readily gain by devoting a little study to the Skunk in his native haunts should cause the thoughtful farmer's boy to hesitate before destroying every Skunk and its family which he may come across.

While it is true that many of these contributors, who have kindly taken the trouble to send their views on the food-habits of Skunks, condemn them, it is a fact worthy of note, in this connection to observe that none of these correspondents who has examined the stomachs of any considerable number of Skunks is found denouncing them. According to my experience Skunks, either alive or dead, are very disagreeable to handle, and to this fact, no doubt, must be largely attributed the censure so many persons heap on them. Furthermore, Skunks are most active in the night time and the many good deeds

* The vertebrates of the Adirondack region, N. E. New York, Dec., 1883.

they do about the farmer's possessions are not nearly so easily seen as are the results of their occasional predatory visits when they kill chickens or suck eggs.

I am a lover of birds—game, song, insectivorous, and raptorial kinds—and with the exception of a few, endeavor in my feeble way, to protect these beautiful creatures which a thoughtful Maker placed on earth to assist mankind. I certainly would have a much higher regard for Skunks if they evinced less industry in seeking the eggs and young of ground-nesting feathered tenants of the fields, clearings and forests, when they go in search of May beetles, larvae, mice and other enemies of agriculture. However, I am inclined to the opinion that Skunks are often blamed for robbing nests that have been visited by other pilfering animals.

The common house cat, concerning which Dr. A. K. Fisher truly says:

"That gigantic * * * fraud, is petted and fed and given a secure shelter from which it may emerge in the evening to spread destruction among the feathered tribe"

does a great deal of mischief in the poultry yard and devours all the wild birds, both old and young, it can catch. It is a sly robber and frequently its depredations are charged to other animals.

Rats, likewise, are cunning and vexatious pests, and their deeds of rapine are often unjustly placed to the discredit of Skunks, Hawks, Owls, Weasels, etc.

It is unquestionably true, as intimated by my friend, Dr. Thornton, that Skunks consume beneficial insects, particularly the predaceous ground beetles, which, with their larvae, catch Army Worms, Cut Worms, etc., yet the painstaking investigations of economic entomologists and mammalogists, prove beyond all doubt that the noxious forms of insect pests which they feed upon are the ones which in the great majority of cases so often distend the stomachs of Skunks they dissect.

The very instructive paragraphs from the pen of Hon. F. N. Moore, a loyal friend, and one of the best and most successful advocates of the agricultural interests that ever represented Bradford county in the Pennsylvania Legislature, explains in a very succinct manner the good habits of Skunks. The terse communication from Mr. Moore's pen shows that the Patrons of Husbandry of his locality have, by a little careful observation, learned the great worth of these animals which are of so much service in protecting their potato and corn crops from "white grubs" that in recent years have been doing a great amount of damage in many parts of this Commonwealth.

This industry, when properly conducted, is said to be a very profitable business. The writer is unable either from personal observation or practical experience to give any information on this matter. In view of the fact that a number of requests have come to this office

from farmers and others who desire to learn some facts about Skunk farming, the following extracts are made from an interesting paper written by Mr. Arthur D. Warner, and published in the "Rural New Yorker," February 13, 1892:

"One of the pioneers in the Skunk-breeding industry is Mr. Henry Gurnsey, of Lima, N. Y. Mr. Gurnsey has been for a number of years a dealer in Skunk and other furs, and about six years ago determined to attempt the breeding of Skunks in confinement. He first inclosed a portion of his back yard by a tight board fence. Then he trapped or bought a few pair of Skunks and placed them in the inclosure. The experiment was a success from the first. The Skunks increased so rapidly as to become at length somewhat of a nuisance within the corporate limits of a village, and Mr. Gurnsey decided to move them to some point in the country where he could engage in Skunk farming on a scale worthy of the name. He found a suitable location about three miles east of Lima village, and formed a partnership with Mr. W. Shaddack, who owns a part of the land now occupied by the farm and who assists in caring for the animals.

"About five acres were inclosed. A trench was dug in line with the proposed fence, and planks were sunk in it a depth of two feet; then it was filled on both sides of the fence with small stones which were covered with earth. The part of the fence above ground is tight and four feet high. On a recent visit to this farm a faint but characteristic odor warned us of the proximity of the "ranch." On arriving it became evident at once that a steep side hill, underlaid by a tenacious clay subsoil and which would be worthless for other purposes, is the proper thing for Skunk breeding. It is only on steep land that the burrows can be made with ease, and all of them have good drainage. The hill rises perhaps to a heighth of 150 feet above the road which runs along the base.

"The face of this incline is honeycombed all over its surface by hundreds of Skunks 'nests,' but during the greater part of the day a casual passer-by will see little of interest within the enclosure at any season. Only occasionally will a Skunk, driven out by hunger, make its way to a portion of some freshly slaughtered animal that has been placed there for food. But about six P. M. on summer days, and somewhat earlier in the spring and fall, the colony begins to show signs of activity, black heads appear, then bodies emerge and make their ways down zig-zag paths of their own making toward the point where food is placed; from this time on during a considerable portion of the night the hillside may be said to be literally alive with Skunks.

"The question of obtaining food for them is the all absorbing one with the proprietors of the ranch. During the woodchuck season they are out day after day scouring the country for these animals, and other hunters are kept busy. But woodchuck, 'coons and other small

game are not found in sufficient numbers, and a large supply of meat is obtained in the shape of domestic animals which have outlived their period of usefulness, or have met an untimely death. The wants of the Skunk breeders are pretty well known all through this section of the county, and they are often summoned by telephone, letter or verbally to go and relieve a man of a decrepit horse, a dead cow or abandoned sheep. When the supply of meat becomes too great for immediate use, it is cut from the carcasses and salted down in barrels in the cellar of one of the buildings which are attached to the ranch. Later on this meat is taken up and boiled in a large cauldron, meal is added and the mixture as well as water for drinking, is placed in a series of troughs along the base of the hill. As Skunks become semi-dormant, they consume but little food during the coldest parts of winter. In spring and fall carcasses are left out for several days until consumed. As this cannot be done in hot weather, the cooked ration is fed largely. The Skunks breed in early spring, eight or ten making a litter. By fall the young ones are full-grown, and cannot be told from the old. Overfeeding must be guarded against, as it reduces the size of the litter.

"Recently I visited the farm during the annual killing, which begins about December. Six or eight men were at work on the steep hillside digging out the Skunks, which are placed in sacks, held by helpers. These holes or nests are made by the proprietors with spades or shovels, by digging downward into the bank for three or four feet. As it is hard to dig under it without causing it to cave, an earth roof is not generally made; instead the large cavity is nearly covered with rails and boards and dirt is thrown over.

"Skunks burrow but little, and in a wild state appropriate the holes of Woodchucks and other burrowing animals. New holes are made as fast as the colony seems to require them. There is no regularity as to the number inhabiting a hole; not less than two or three were found, but in some cases fifteen or twenty had crowded together in one hole.

"The males also were found collected in one portion of the grounds. At the 'Skunk harvest' the roofs are thrown off the holes, and a little digging brings out all that are inside. When a bag is filled, a man throws it over his shoulder and carries it down to the skinning room. Here the animals are sorted. The best marked are saved for breeding, one in ten being a male. They will be kept in the building until all have been dug out, when they are turned into the inclosure. Those to be killed are taken outside and dispatched by a blow on the head, and skinned as soon as dead. Only rarely do they throw scent at this operation. The skins are hung up to dry with the flesh side out. The building contained many Fox, 'Coon and Muskrat skins, besides hundreds of Skunk pelts. The output of the ranch will be about 800 skins this year, as many live Skunks will be kept for the

next year's breeding. Before the carcasses are removed after skinning, the fat is cut off and fried into oil. Good black skins are worth in the neighborhood of $1.50 each."

WHAT FARMERS, POULTERERS AND SPORTSMEN SAY ABOUT SKUNKS.

ADAMS COUNTY.

Dr. C. E. Goldsborough, Hunterstown:

Polecats are an abomination; they kill chickens, rob hens' and birds' nests, bee nests; but they are supposed also to destroy much vermin. We find Skunks or Polecats very common. Woodchucks or Groundhogs rare in lowlands, tolerably common in highlands. Rabbit or Cottontail numerous everywhere. Wildcats common in mountains of the county; field or meadow mice very common; Minks, Moles and Weasels common, Foxes common, Muskrats very common, Squirrels, Raccoon and Opossum common.

ALLEGHENY COUNTY.

L. B. Schnatterly, Freeport:

They are a great enemy to the farmer's poultry and very destructive to nests of Partridge (Quail) and Pheasant. Mr. James Harbison tells me that he caught a Polecat destroying a nest of eggs of Quail that was just ready to hatch out. The Groundhog will do the same.

BRADFORD COUNTY.

E. M. Angle, Potterville:

Skunks are destructive to Rabbits, Pheasants and Quail. I have known them, with the Red Fox, to be most destructive to the above mentioned game. Proof, localities where the Skunk and Fox are nearly extinct you will find said game in plenty and vice versa. They are also injurious to the farmers' fields; in the absence of game, poultry, etc., they will take to the meadows and pastures if the land be sidehill or sloping will commence at the lower side and turn over every movable stone that is not too large for their strength, in search of ants, tumble bugs, eggs and crickets, and some certain grubs and worms. This, some may say, is beneficial; if so, the damage done is so much greater than the little good, that the good sinks into insignificance. I had a meadow of about three acres sloping to the north east about two years ago, well seeded to timothy and clover, and when mowed of a splendid stand, directly after mowing they commenced in the aforesaid way at the bottom and turned the stones over a few rods of ground every night (for like all evil doers they work at night) until they reached the top; by that time there had accumulated the same food under the stones again and they would overturn every stone, placing the stone on new grass after having left it just long enough to kill the grass where it lay, the sun, wind, and overing having destroyed the grass until the field was ruined until taken up and newly seeded. Having witnessed the aforesaid charges against this animal I have no hesitation in saying they are one of the farmer's foes. Yes, sir; they are worse than a mortgage on your farm drawing compound interest, for they increase faster and in a greater ratio, and I am in favor of a light bounty, say,

with the present price of furs, twenty-five cents per head, but please don't give a larger one to the justice unless the law be so amended that the said justice of the peace must skin them.

I consider the Skunk very injurious, for the following reasons: In localities where farmers do not have good protection for their poultry they will destroy both old and young that roost low enough for them to reach. They are cunning fellows and show great wisdom, if a young turkey or guinea fowl are apt to wander to a distance that they may hide their nesting place, the Skunk, keen of scent, soon locates the nest and eats the eggs; should the birds be lucky enough to lay their quota and commence setting, of course, the odor is still stronger and the Skunks can scent at a greater distance, they will drive off the birds and eat the eggs, being careful to save the birds that they may keep them supplied with such toothsome food and will not kill "the goose that lays the golden egg," until they see they are not likely to get any more or driven by excessive hunger to attack the mother bird. This same being true should they come upon the mother bird while with their young, they will destroy the young by piece-meal as they will have need, not like the Mink or Weasel, destroy for the blood and leave several dead in a pile.

Hon. F. N. Moore, North Orwell:

Skunks are quite plentiful in my locality, but twenty years ago they were much more numerous, and at that time we did not experience the great losses we now sustain in our meadows through the ravages of white grubs which are the larvae of the May beetle or tumble bug. In this region we grow potatoes extensively for the eastern markets and experience material losses to the potato crops as well as to corn by reason of the white grub eating them. These inroads made by the white grub became of such a serious character that it brought out discussion among our farmers at local grange meetings, when it was learned that the potato and corn fields most adjacent to sections where Skunks harbored, were least damaged by these larvae. Observation proved that the Skunks, to get the grubs, dug small round holes in the hills and rows of the potatoes. The testimony of our observing and intelligent farmers is that the Skunk is the greatest enemy to these noxious pests, for he not only seeks them in the plowed ground, but will dig for them in the meadow and pasture lands.

Skunks, as is well known to every one, will turn over flat stones, pieces of wood, etc., which serve as harboring places for crickets, ants, grasshoppers, army worms, May beetles and other forms of insect life which subsist on the farmers' crops. While it is true the Skunk will occasionally visit the hen roost or get under the barn to the dismay of the farmer's dog, and the disgust of the farmer's boy, yet the damage which he does in the poultry yard is light when compared with his beneficent services, rendered in destroying insects, mice and other vermin which attack the farmer's crops by day and night. The Skunk is the most profitable source of revenue of any of the fur-bearing animals captured by the juvenile trappers and hunters in one section. Many a boy is made happy with a new pair of skates, and a cheap shotgun, secured by barter at the country store in exchange for pelts of this highly perfumed animal.

My observation as a practical farmer is that these animals are certainly friends, not enemies of agriculture, and that the indiscriminate slaughter of them or a bounty which will encourage their extermination would be prejudicial to the farming interest.

J. S. Gay, Terrytown:

Skunks are very injurious; they are very plentiful and will catch all the chickens that they can find; also suck eggs.

W. R. Parks, Athens:

Injurious; destroy eggs, game and eggs of game birds. Being a sportsman I desire to protect game and favor the killing of the Skunk.

BUTLER COUNTY.

John F. Weakly, Slippery Rock:

I think Skunks are a benefit, as they live almost entirely on bugs and worms.

CARBON COUNTY.

M. E. Kemmerer, Weissport:

Skunks kill chickens and other kinds of poultry.

CENTRE COUNTY.

T. H. Harter, Bellefonte:

I think the Polecat is the most destructive to our game, as it does its work at night and catches the birds while hatching. In my opinion Skunks are injurious because they feed upon game when they can get it. I consider them next to the Hawk in destructiveness to game.

CAMBRIA COUNTY.

Mr. Pierson, Dysart:

Skunks eat eggs of the ground birds (the kind that are beneficial to the farmer, such as Thrush, Catbird and native Sparrow). They have killed a great amount of chickens around here; have lost some myself and set traps and caught them in my hen house. They are injurious.

John F. Thomas, Carrolltown:

While the Skunk devours many insects and other vermin, it is obnoxious to the farmer and sportsman. They are invariably around on wet nights, when they may be found prowling around the barn or hen coop, and have even been killed in cellars of inhabited houses.

Their methods of procuring insects manifest much cunning. I have seen them go about a field in the evening overturning all small flat stones in their way, and quickly gather up all the surprised bugs and beetles. It is unsuspecting and may be taken with a steel trap very easily.

CHESTER COUNTY.

Thos. B. Darlington, West Chester:

The Skunk or Polecat is a frequent visitor to the poultry yard, for poultry or eggs, or both, and breaking up setting hens.

A. Sharpless, West Chester:

The Skunk has been pretty plentiful here in years past. I think it is more beneficial to the farmer than otherwise. True, old ones sometimes destroy young chickens when exposed at night, but their food seems principally to be noxious insects; I long since forbid their destruction on my farm. There will be no danger here of any surplus of these animals, as the value of their pelts is such that trappers will keep their numbers down.

Harry Wilson, Gum Tree:

In my opinion are one of the most beneficial animals; their principal food as shown by their stomach and excretions are insects, such as beetles and grasshoppers. I had an illustration of their food-habits shown to me a couple of years since. I had been hunting Groundhogs one summer evening and returning through a clover field near a woods I saw a small black animal moving about in the grass near my intended path. I soon found on nearer approach it was a half-grown Skunk; so coming to a stand I watched its methods of getting a livelihood; it wandered first one way and then another until it came within a few feet of me standing quite still, it never took the least notice of me. It was searching for grasshoppers as was evident from its actions. Walking with its short legs it made a sort of stiff, wriggle-like progress; when it came across a grasshopper, stiffened by cold and dew after nightfall, which would hop but two or three inches, it gave a short spring, placing both paws on the 'hopper, which it proceeded to eat at leisure. I watched this Skunk until too dark to see its operations any longer and his method of capturing was always the same; catching the insect with his paws first. When a Skunk, however, acquires a taste for hen eggs and young chickens, death alone, I believe, will stop his ravages in the poultry yard, and I have had annoyance given me by them; but the death is easily effected, an egg containing strychnine proves very tempting and he commits suicide. I believe that could the Polecat be educated to abandon the habit of using perfumery and eating a chance chicken (which might afterwards die of gapes) which might come in his way, he would become a highly beneficial and useful animal to mankind.

Dr. Walter Van Fleet, West Grove:

Skunks beneficial; stomachs usually filled with insects.

CLEARFIELD COUNTY.

J. Blair Read, Clearfield:

Injurious; destroying poultry.

James Thomas, Curwensville:

I had forty young and an old turkey killed in three successive nights by a Skunk. I trapped it and it was not a very large one either.

Abraham Neveling, Coalport:

Skunks are injurious, they destroy poultry and eggs.

E. Gard Edwards, Ramey:

Skunks are more injurious than otherwise on account of depredations on poultry.

W. J. Stull, Coalport:

Skunks injurious; destructive to poultry.

Enos Bloom, New Millport:

The Skunk or Polecat is very common and very destructive to poultry and eggs. They are so bold that they will enter a poultry house or anywhere else that they can, in broad day light. They are very destructive to Pheasants and Partridges, eating both eggs and young.

CLINTON COUNTY.

L. M. Castetter, Green Burr:

Some people think Skunks harmless, but they are the most destructive animals to birds that build their nests on the ground, such as the Lark, Quail and Pheasant, as they are fond of such food as birds' eggs and young birds. They visit the poultry yards very often in our section and kill lots of poultry; they are very plentiful because not every one will kill them on account of the offensive musk they will discharge when pursued. Our Quail are very scarce, and I blame nothing but the Skunk for it.

CRAWFORD COUNTY.

W. G. Sergeant, Meadville:

Skunks do no especial harm; many are taken for their fur.

Hon. J. B. Phelps, Conneautville:

The Skunk is the farmer's friend. I have watched them hunting grasshoppers and digging out grubs in the field.

H. C. Kirkpatrick, Meadville:

The Skunk destroys poultry and eggs, and in my opinion is injurious, but to what extent I cannot tell.

COLUMBIA COUNTY.

E. H. Davis and John M. Buckalew, Fishing Creek:

Would estimate that about 1,000 skins of Skunks are obtained annually in this section.

Polecats catch a few mice, bugs and insects when they cannot get a meal of Quail, Pheasants, or their nests of eggs or young, or Rabbits or their nest of young. We sometimes offer a local bounty to the boys—to the one producing the most scalps—and always see beneficial results in Quail and Pheasants increasing, as well as Rabbits thereafter.

CUMBERLAND COUNTY.

Jacob Meixel, Boiling Springs:

Skunks are injurious; they destroy young chickens and leave a disagreeable odor. I have known Skunks, Opossums, Weasels and Minks to kill much poultry and game; they generally destroy all that are at one place.

FAYETTE COUNTY.

N. W. Miller, Uniontown:

Skunks are valuable, they exterminate field mice and rats. Some of our farmers have forbidden the trapping of Skunks on their farms, because they keep their meadows free from rats and mice.

FRANKLIN COUNTY.

Hon. A. Nevin Pomeroy, Chambersburg:

Skunks are injurious; destroy poultry.

GREENE COUNTY.

B. F. Herrington, Waynesburg:

Skunks beneficial; they destroy a great many meadow mice.

HUNTINGDON COUNTY.

Geo. S. Appleby, Decorum:

Skunks injurious; they destroy poultry.

INDIANA COUNTY.

Wm. D. Rombach, Saltsburg:

Skunks are very injurious to all game, while they destroy many moles and mice; their pelt is big premium to kill them.

L. C. Oberlin, Smicksburg:

Last winter I believe I handled over 1,000 Skunk skins, besides hundreds of other kinds. Skunks are plentiful all over the country; I am sure that they are beneficial to the farmer; they kill mice, destroy bee, wasp and yellow jacket nests. Very little harm to poultry. On the other hand, their hides are very valuable.

Samuel Bothel, Shelocta:

I think they destroy quantities of bugs, grasshoppers and bumble bees, grubs, etc., that are more of a pest than they.

R. W. Wehrle, Blairsville:

Injurious.

JUNIATA COUNTY.

W. H. Knouse, Swales:

I am firmly convinced that Skunks are beneficial. I have known them to harbor in buildings and have not heard of a single instance in which they destroyed poultry or eggs, of which they are sometimes accused. To the contrary, they destroy large numbers of field mice, bugs and worms. My boys catch them sometimes and upon examination we find that the contents of their stomachs verify this statement.

Wellington Smith, Mifflintown:

The Skunk is the boldest and most plentiful of all poultry destroyers; I have really killed as many as six in one season right in my barn. Last summer I shot one in broad day light in the feed entry. It is surprising how nicely they can eat your eggs for a long time before you know what becomes of them, and eat your chickens too. His depredations will always be saddled somewhere else.

LANCASTER COUNTY.

Messrs. H. M. Engle & Son, Marietta:

The Skunk is quite common and the damage done by them is not very great. I know they destroy eggs and poultry; whether they destroy field mice, as it is claimed, I do not know.

LACKAWANNA COUNTY.

F. L. Benjamin, Kizers:

Skunks occasionally kill chickens and eat their eggs.

A. C. Sisson, LaPlume:

Skunks occasionally destroy poultry and eggs in a small way, but subsist principally upon bugs, worms, ants, etc., and are a benefit rather than a damage to farmers. The Skunk is one of the farmer's best friends, and should be protected to the fullest extent. He lives largely upon insects that are detrimental to the farmer. The May beetle and its larvae, that are so rapidly becoming destructive to many of our crops, are especial favorites with him, and unless the wholesale trapping and killing of these useful animals is prohibited by stringent legislation, strawberry growing will soon become entirely unremunerative in many localities, for it is generally believed that if the Skunk could be let alone, he would keep this pest in check to a very great extent. The damage to the potato crop by the white grub is rapidly increasing, and calls loudly for prompt action to suppress this evil.

In these days of agricultural depression, when new industries are eagerly sought that offer profitable results, we would recommend Skunk farming. It has been demonstrated that these little animals can be grown to an almost unlimited extent, and at the same time afford a pleasant lucrative employment. Our American ladies delight in wearing the excellent fur of these little animals, although usually under the assumed name of expensive furs of animals now nearly extinct. The pelt of a black Skunk will bring from $1.50 to $2.00 each, and the oil of a fat Skunk $1.00. They are as prolific as swine; they usually breed twice in a season, and drop from six to twelve at a litter; they are easily domesticated and become as gentle as kittens, and can be handled with impunity if the tail is used as a handle. Unlike our farm stock, they require no feeding in winter; they hibernate, only making their appearance at rare intervals when the weather is mild; their food is refuse meat and bones from the butcher shop, mush made of wheat bran and cow's milk. When they are ready for slaughter, they are first chloroformed, and when the oil is extracted they can be fed to the rest of the herd. The Ithaca Fur Company, of Ithaca, New York, have perhaps the most extensive Skunk farm in the United States, situated about seven miles from that city, where several thousand of these useful animals may be seen at any time during the summer months by those who care to investigate this comparatively new and unique enterprise.

Ziba Scott, Spring Brook:

The Skunk is a very mischievous animal, he is not a fast runner, but sneaks around the chicken coops at night and sucks all the eggs he can find. If a hen or turkey steals its nest in the field and sets there he is pretty sure to get the eggs. He serves the Quails and Pheasants the same way.

LEHIGH COUNTY.

W. B. K. Johnson, Allentown:

In a poultry yard I should not want skunks; they love eggs too well and have often come from the woods to steal eggs in our barns during winter, and were caught entering a square hole for cats to enter, and after feasting on eggs were not able to repass and were caught.

LUZERNE COUNTY.

John E. Stocker, Ashley:

Skunks are injurious and dangerous. I know of a family by the name of Bergers, who lived along what is known as the middle road between Ashley and Buttonwood, about a mile from here, who had a very nice flock of ducks and chickens. There is a running stream about a stone's throw from the house, and on the side of a small hill they had built a coop to house their flock; it was not long before Mr. Berger noticed the number of his flock going down; his idea was that they were stolen. One night he had occasion to go out on a bright moonlight night, he noticed what he thought were two dogs playing in the road; he moved a little closer and soon found they were Skunks; he was attacked by them and it was all he could do to get away. Had it been a child instead of a man, as a result he would have been killed or nearly so. Mr. Berger's suspicion was aroused and he made a hunt around his premises; the nest containing five young was found under the pen; of course they were all killed, as was one adult.

M. B. Trescott, Harveyville:

The Skunk is injurious. It is a great destroyer of eggs, robbing hens' nests, particularly those "setting," and destroying whole broods of young chickens in a night and sometimes killing an old one. I have known a number of instances where they have got into out kitchens and cellars, and spoiled by their "scent" nearly everything stored there. I do not know of any good they do.

LAWRENCE COUNTY.

Hon. A. L. Martin, Enon Valley:

Preserve the Polecat.

McKEAN COUNTY.

C. W. Dickinson, Norwich:

I certainly think the Skunk does more good than harm for he is an enemy to the grasshopper, the cricket, the white grub, and nearly all kinds of beetles. The Skunk lives on the above named insects and only when they are scarce will he make a raid on the farmer's poultry or eggs. I have known Skunks to kill chickens and devour a whole nest of eggs.

Noah H. Parker:

The Skunk never does any damage except he gets into the chicken coop, and then he will sometimes kill several in one night and often will repeat his visits if left undisturbed.

G. R. Brownell, A. P. Pope and W. R. Page, Smethport:

Kill chickens and furnish material for fur capes.

A. P. Brewer, Norwich:

Skunks are quite plentiful in this county and are considered a great nuisance on account of their perfumery, and because they are destructive to eggs and young chickens.

J. R. Oviatt, Norwich:

Consider the Skunk a benefit to the farmer, as they catch mice, beetles, larvae, etc.

MERCER COUNTY.

A. D. McCracken, New Lebanon:

We have lost young chickens and so have our neighbors, as many as fourteen at one time; supposed it was a Skunk or Polecat, for when a Skunk was captured we lost no more chickens that year. Skunks are considered by some as beneficial to the farmer; I think they are injurious. They are becoming scarce, which I believe will be beneficial to the farmer and poultry raiser.

M. S. Osbourn, Henderson:

The Skunk, I think, is a friend to the farmer in many ways; he sometimes may kill a chicken, but this is overbalanced by the good he does in the field by catching mice and other harmful forms of animal life.

Arthur Martin, Sandy Lake:

We have the Skunk; they are the farmer's friend; they destroy more mice than any animal we have; we have a great many mice in our clover fields; we will notice late in the fall when a small skift of snow falls, the clover field is traveled over and a great many mice killed in a single night by the Skunk.

MIFFLIN COUNTY.

Jos. W. Kyle, Milroy:

Injurious.

MONROE COUNTY.

H. M. Frankenfield, Frutcheys:

I would consider Skunks beneficial to the farmer, as they catch the Meadow or Field Mice.

Mrs. Alma S. Williston, Frutcheys:

Last April my boy of ten years trapped a Skunk in our next neighbor's chicken yard, and wanting to sell her to a "Skunk Park" on the Delaware, about five miles from here, he put her in a box and kept her until he had a chance to send her to the park; he had her two days when she gave birth to a litter of seven; of course he was more anxious than ever to keep her until the little ones were large enough to sell, so he tried giving her fresh eggs, one three times a day, she liked them well and the whole family throve nicely; she would take the egg between her front feet and bore a small hole in the end with her teeth and suck the contents. We kept them three weeks and then took them to the park. In the meantime the mother became so tame my boy could handle her with impunity, take out the little ones when he liked and look at them without the mother interfering at all. I was sorry he did not keep them until they grew large, for at the park they had poor success in raising the young. They said the old ones ate them, I do not know why, as the one we had seemed very fond of the little ones.

Emil Ulrich, Stroudsburg:

If it were not for the odoriferous propensities I should think the Skunk a great friend of the farmer. He may occasionally destroy a nest, eat some young birds, but his delights are ground hornets' nests and grubs and worms, after which he will dig in the field. I have noticed the numerous small holes made by Skunks when searching for grubs.

MONTOUR COUNTY.

J. L. Brannen, Exchange:

Skunks are injurious to poultry and game.

PERRY COUNTY.

F. M. McKean, Ferguson:

Skunks are tolerably common in our parts, more numerous than they were a few years ago. They are certainly destructive of game, destroying the eggs and brood; they also destroy young rabbits. They seldom now approach farm buildings to molest young poultry as they did fifty years ago, for as the country is improved they are destroyed.

C. R. Noyes, Westport:

Skunks rob chicke ı and turkey nests and frequently · ill turkeys and chickens.

PIKE COUNTY.

C. P. Mott, Milford:

Skunks are not very numerous in our county, and the mice, etc., destroyed by them more than compensates for the very small damage that they do to poultry.

POTTER COUNTY.

O. J. Jackson, Borie:

The Skunk does some damage to poultry.

SNYDER COUNTY.

F. J. Wagenseller, M. D. Selinsgrove:

Skunks are injurious; have known them to kill chickens, destroy birds and small game.

SOMERSET COUNTY.

E. B. Hostetter, Kingswood:

The Skunk is a very injurious animal, will kill all the feathered fowls, such as chickens, turkeys, pheasants, quail, etc.

Jeremiah Phillips, Garret:

Skunks suck eggs and sometimes catch chickens and ducks, but not often.

Dr. A. D. Moore, New Lexington:

Skunks. Both beneficial and injurious, but I believe the injury outweighs the benefit. If there were not any ground nesting birds or fowls, I have no doubt he would make a good living on grubs, bugs, etc. I have a very poor opinion of the Skunk. He is entirely too familiar; when he goes on a visit he is liable to stay a whole week, and if you disturb him the whole neighborhood finds it out and everybody is down on him, bounty or no bounty. Allow me to digress a little from your question and say that I haven't the least idea in the world what the Skunk was created for. He doesn't seem to have any sense at all. I never

knew one to turn short around and start for home, if he didn't find a barn, or log, or the fence around a ten acre field to turn him he would go on forever. I have met him at all hours of the night, on the walks around my house, office and stable, and he always has the right of way. Coming home late at night I have found him in possession of the premises. By manoeuvering around and calling to my wife to hand the shotgun out of the back window I have been able to convince him that he had been jumping my claim.

Josiah Pyle, New Lexington:

Skunks are injurious, they will come to the farmers' barns at night, and if there are any young chickens about the barn that are not shut up he is sure to get them; it matters not how many young chickens are there, he generally takes them all; it is no mystery when the farmer gets to his barn in the morning and finds them all gone what has taken them—the smell tells the story. I cannot see in what way they are a benefit.

SULLIVAN COUNTY.

Otto Behr, Lopez:

Think Polecats are beneficial to the farmer, the damage they do in occasionally eating the eggs out of a nest out doors, or catching a setting hen is more than balanced by the insects they feed on.

J. K. Bird, Millview:

The Skunk is one of the worst pests the farmer has, often coming to our doors and poultry houses and robbing eggs and young chickens from under the hen, and many times killing old fowls. I would recommend a bounty of one dollar on Skunks.

C. F. Hunsinger, Colley:

I consider the Skunk more of a benefit than an injury, for the reason that I know of many parties who trap them, making good wages selling their hides and a good, fair income by frying out the oil from the carcass, which is a useful and valuable oil.

SUSQUEHANNA COUNTY.

Jasper T. Jennings, New Milford:

The Skunk does little or no damage to crops of any kind. Their principal depredations are among the chickens and young poultry. I have often known a whole brood of young chickens to be destroyed by them in a single night. They often burrow under some rock or go into a Woodchuck hole near the farmer's dwelling and prowl forth at night in search of prey; they are great destroyers of meadow mice and dig out hornets' and bumble bees' nests for the larvae of the bees; they are rarely seen in the daytime, but when so found will often follow a person to throw their almost unendurable odor upon him. Skunks bring forth several young at a time and increase very rapidly. They are taken quite extensively in the fall of the year, when their fur is good, by means of a stone trap, with a figure four, denominated a "dead fall." The bait is generally composed of a chicken's head or entrails; the boys, as well as some men, derive no little pleasure as well as some profit in running a line of traps.

S. S. Thomas, Lynn:

Skunks very common, think fully 3,500 are killed in this county annually.

Woodchucks, about one to the square acre. Rabbits quite common, diminishing before ferrets. Wildcats, quite rare, in fact almost unknown in this part of the county. Meadow Mice, exceedingly thick some years, in others rare. Minks and Weasels quite common, but diminishing. Squirrels, Pine, common; Gray plenty when they migrate this way; Black, nearly or quite extinct. Raccoon, occasionally seen, less plentiful than formerly. Opossum, very rare. Black bear unknown in this part of the county; one killed near here some twenty-five years ago.

Am inclined to believe that the Skunk by his ceaseless war on other vermin compensates for the damage he does to the poultry. I have twice caught him at the bee hives scratching the outside of the hives to bring out the inmates and devouring them as fast as they appeared. This was just at daylight in the morning.

M. B. Lymon, Lynn:

Skunks. Beneficial in killing mice, grasshoppers, insects and other noxious insects, evidenced by upturned stones and shallow punctures in meadows where they are often seen.

TIOGA COUNTY.

P. W. Rexford, Mansfield:

I think Skunks are injurious, for they rob all birds' nests that are on the ground and they are bad on poultry.

UNION COUNTY.

Geo. W. Chambers, Mifflinburg:

Skunks are certainly of no benefit to farmers or anybody else. I know that I have a good deal of trouble with them and would be willing to pay fifty cents a scalp. I have had to fight them for years. If they get under a floor in the barn or house they will destroy every egg and chicken in a short time. The act paying fifty cents a scalp should never have been repealed, if it had not there would not now be a Skunk in this county, and that would have been a benefit to the whole country.

Dr. Thomas C. Thornton, Lewisburg:

Poultry raisers in this section suffer considerable loss yearly from the depredations of Hawks included in the genus Accipeter.

The Great Horned Owl and sometimes the Barred Owl also destroy domesticated fowls. The Duck Hawk and its smaller relative, the Pigeon Hawk, and the Bald Eagle will kill domesticated fowls. Among mammals, the common Weasel, Mink, Wildcat, and both kinds of Foxes also destroy a large amount of poultry every year; and these four depredators in common with the raptorial birds above cited do a great deal of mischief by destroying game—birds and mammals—as well as many small beneficial song birds. The Mink, which lives in the vicinity of water courses, in addition to doing many other bad deeds, destroys fish; large size trout seem to be most agreeable to the taste. While hawks and owls, like some of their mammalian contemporaries do not, so far as I can learn, disturb the eggs of poultry and wild birds, we have the pestiferous Skunk, which is a most adroit nest robber. This animal, like many other evil doers, goes about in the dark to kill poultry or eat their eggs, and when these cannot be readily obtained he attacks the eggs and broods of all ground nesting birds he can find. Skunks do much damage to poultry, and the havoc they make among game birds, espe-

cially Turkeys, Quail, Pheasants and Woodcock, should prompt every lover of the dog and gun to extirpate these sneaking and sly pilferers. They, of course, prey to some extent on different forms of insect life, but, possibly it may be they consume almost as many beneficial species as they do of noxious kinds. Some observers believe this to to be the case, and if they are correct, then there can be no room for doubt that the whole Skunk race should be exterminated, as their ravages in poultry yards, to game and to insect-devouring birds is well established.

C. K. Sober, Lewisburg:

The Skunk, or Polecat, as this nocturnal quadruped is called by many, is, according to my observation, a most despicable animal. While it is probably true that he destroys some destructive larvae and beetles which subsist on the farmer's crops, the damage he and his numerous family occasion by frequent visits to the hen coops is considerable. I think the loss to the farmer and fruit grower, through the destruction of the eggs and young of insectivorous birds by Skunks is much greater than the good these animals do by devouring crop-destroying insect pests. Sportsmen who desire to see the game birds increase, very generally favor the extermination of Skunks, because they devour the eggs and young of Pheasants, Turkeys, Quail and Woodcock, and they eat sometimes young Hares. They also catch, it is said, destructive mice in meadows where they hunt for food, but in such places I have little doubt they do much injury to small song and insectivorous birds, as they will not hesitate to rob all the nests which they can reach as they slowly and methodically hunt over the ground in the twilight, moonlight and dark.

VENANGO COUNTY.

L. T. Wilt, Franklin:

Skunks are no doubt beneficial as well as injurious. If left alone they will injure no one, except in case of extreme hunger or on being molested. Why not rate him among the higher order of mammals, on account of nature endowing him with the faculty as chemist of preserving so fine a weapon of defense and in so fine a chemical state of sub-division and in so small a laboratory and capable, with a very slight effort on his part, to open his laboratory and in an instant perfume so great an amount of atmosphere?

H. C. Dorworth, Oil City:

I consider Skunks injurious for the reason that they will kill poultry and eat eggs. I have been told that the stench from these animals is readily taken up by milk; I know that local dairymen are bothered by these animals.

Many instances of Weasels and Polecats killing poultry in this county have occurred. I know of a case where a farmer hearing a commotion in his chicken coop, went to investigate; he got there in time to see a weasel killing the eighteenth chicken. James Black, of Black Siding, this county, not long ago lost twenty fine White Brahmas. The Weasel had come up through a crack in the floor, killed the whole flock and dragged every chicken to the crack. The owner found his twenty chickens in a row along this crack with their heads drawn down through it. The Polecat does not kill as many chickens at one time as a Weasel; one or two usually satisfies his hunger.

WASHINGTON COUNTY.

George Montgomery, Washington:

The Skunk has been very destructive at times to our poultry, a few years ago

one was quartered under the coal house, not more than twenty feet from the kitchen door, and took two dozen full grown hens before we discovered his whereabouts. I had no dog at the time and that was perhaps the reason he took quarters so near the house.

There was another one a few years after, which was under a pig pen in the orchard, that gave me considerable trouble, and destroyed many eggs and chickens, before I succeeded in killing him. There is one at the present time staying under our barn, which we have not succeeded in capturing; he has killed many chickens for us the past summer and eaten a great many eggs. There have been six Skunks killed on this farm this year. I have been advised to let the one remain at the barn so long as he does not kill the chickens, and have a dead sheep or something of the kind for him to nibble at, but my sentiments don't tend that way.

Jas. S. Nease, Washington:

During the year 1870 Skunks were very abundant in Washington county. I saw one in the town of West Alexander in the chicken coop eating a young chicken. I think it had killed two or three and destroyed some eggs under a hen. This was early in the evening, about eight o'clock. Father shot it while it was eating the chicken.

During that winter Skunks would come into the yards in town and on soft nights scratch on the bee hives and when the bees came out would eat them; this weakened the hive. When the ground was muddy (the kind of weather Skunks prefer to travel) they would leave the hives muddy where they scratched it at the hole left for bees to enter. At this time Skunks were hunted very little for their fur, but in a few years thereafter the fur brought a good price and they have become much scarcer. The incentive in obtaining its pelt has so reduced it in numbers that it now ought to be protected for the good of the farmers. They now stay far from dwellings and those which remain are needed to kill mice, yellow jackets, hornets and bumble bees. The Skunk when not exceedingly numerous is very useful. The price of the fur makes it sought after and keeps its numbers greatly reduced. It should be protected for a year or two.

WAYNE COUNTY.

G. C. Bell, Maplewood:

Injurious by eating up our small birds' eggs.

G. W. Wood, Equinunk:

Skunks are odious and odorous; destructive to poultry, worse even than foxes.

Paul Swingle, South Canaan:

Skunks are very injurious by destroying poultry.

John Kellow, Carley Brook:

Skunks like good, fat poultry, but I do not think they are very destructive, while they also catch mice; while we do not know how many mice they catch they might balance accounts.

E. B. Gager, Dyberry:

Skunks kill our chickens and eat our eggs.

Geo. Franc, Ariel:

Skunks quite common. Destructive to poultry.

Geo. M. Day, Dyberry:

Skunks are beneficial. They destroy many bugs, beetles, squash bugs, bumble bees, nests, etc. Where do they collect and bottle up their ammunition for defense if not in our fields and pastures? Step on a lot of large bugs found on the squash and pumpkin vines, then interview a Polecat, at a safe distance, and see if the perfume is not the same. Now, if they are willing to pick up a living in that way, and grow fat on it, why not let them?

C. W. Pennel, Hemlock Hollow:

The Skunk is very destructive to poultry of all kinds and is quite plentiful here. I have known the Skunk to destroy nests of eggs and whole broods of young chickens in a single night. I am sure it was a Skunk, as I put a steel trap in a nest with a few eggs and caught him the next morning. Think the State should pay a bounty on the Skunk.

N. F. Underwood, Lake Como:

Skunks are plenty here; do not do much damage; they will occasionally kill chickens.

Peter Covey, Newfoundland:

Skunks are common; from personal knowledge know they are injurious to poultry.

WESTMORELAND COUNTY.

John Nicholas, Bradenville:

The Polecat is an animal most unpleasant in many respects, but must like all other animals, have been created for some purpose. It is only within a year that I have discovered their use to man. Most all animals prey upon one another, the Skunk upon field mice and what is called the "hop grub;" he should be protected as beneficial to man.

W. C. Sloane, Sloane:

Skunks carry off young chickens.

YORK COUNTY.

Dr. Wm. B. Bigler, East Prospect:

Skunks are injurious. I know they will destroy eggs and sometimes chickens.

I. D. Howell, York:

Skunks or Polecats are plentiful, and in my opinion, based on experience and observation of over fifty years, they are the most destructive vermin in the whole catalogue as regards wild game and all forest birds that hatch or build their nests on the ground: Wild Turkey, Pheasant, Partridge or Quail, Woodcock or Snipe, Lark, Whip-Poor-Will, or Night Hawk, Sparrows and all of the bird kind which nest on the ground. They are great workers, constantly rooting over the surface of the ground, turning up the leaves and decayed matter, hunting bugs, "clocks," ants, worms, insects of all kinds. These habits bring them in direct contact with the hatching fowl; the mother bird usually escapes but the eggs or young birds are easy prey for the Skunk. I have known them to take the eggs from under a tame turkey and not disturb the old bird. They are a great damage to all kinds of poultry; they sometimes go in families, as many as eight together.

THE VACATION SEASON.

Some of the Many Resorts in Pennsylvania Where the Tourist Can Spend a Pleasant and Profitable Vacation.

In view of the fact that the author is frequently in receipt of inquiries as to localities where the natural history student or sportsman can have an enjoyable vacation, it has been deemed advisable to make brief mention of a few of the principal resorts which are easy of access, and where ample accommodations may be obtained at reasonable rates.

Notwithstanding the fact that various railroad companies operating in the Keystone State disseminate much information of particular value to the pleasure seeker, through the aid of guide books and other means of advertising, it is noticeable that such meagre mention is made of birds and mammals, as well as of the finny tribes, that but little knowledge of practical utility is to be gained by either zoological students or sportsmen, whether gunners or anglers.

Limited space and lack of time unfortunately prevent the writer from giving in this volume a complete hunting and fishing guide (which is at the present time in course of preparation) of Pennsylvania and neighboring states.

Fur, Fin and Feather.

The birds of Pennsylvania include, in round numbers, about three hundred species and sub-species, which occur here either as permanent residents or temporary visitants. West of the Allegheny ranges the bird life differs somewhat from that found east of the same mountains.

At certain localities on the Lake Erie coast, which forms about fifty miles of our extreme northwestern boundary, different kinds of aquatic birds abound during their vernal and autumnal migrations, while in other sections of the Commonwealth these same species—several of which are eagerly sought by the gunner—occur irregularly, or in such small numbers, that they cannot be hunted with any reasonable hope of success, i. e., from the average sportsman's standpoint. The botanist, ornithologist or mammalogist who will explore the regions through which the Susquehanna, Allegheny, Juniata, or Monongahela rivers flow, will be amply repaid for his trouble, and a visit to almost any of the highest mountain ranges will show an indi-

genous faunae, noticeably different from those in less elevated regions.

Following is the list of native mammals occurring in Pennsylvania which are hunted either for food or on account of commercial value of their skins: Deer, black bear, squirrels (gray and black), gray rabbit, varying hare, raccoon, opossum, foxes (red and gray), wildcat, muskrat, skunk, otter, pine marten and fisher.

Of this list the pine marten and fisher are exceedingly rare, and are known to inhabit only a few localities in the State.

The waters of Lake Erie and Presque Isle Bay, at Erie city, the western terminus of the Philadelphia and Erie Railroad, abound in a large variety of fish, which, in the summer season furnish delightful sport to those interested in such diversion. Many of our picturesque and cool mountain streams are celebrated for their brook trout; some of the best trout streams are in Monroe, Pike, Wayne, Columbia, Cameron, Clinton, Sullivan, Potter, Blair and Lycoming counties. The chief objection made by many fishermen to trout fishing in this State is the rather small size of the fish. Brook trout can be taken, according to the laws of Pennnsylvania, from April 15 to July 15.

Conneaut Lake.

A beautiful and healthful summer resort, a lake three by one and a half miles in size, is located in Crawford county, northwestern Pennsylvania, twelve miles from Meadville. Several steamers and a small fleet of sail and row boats ply on the waters of the lake; the hotel rates are reasonable and there are good camping grounds adjacent to it. The waters have recently been stocked. Salmon, black and yellow bass fishing are reported to be good. In a number of the large lakes situated in northeastern Pennsylvania, particularly in Susquehanna and Wayne counties, bass and pickerel fishing is pursued with considerable success. The concluding paragraph concerning some of the principal bass fishing points on the Susquehanna river are taken from Spangler's Directory.

Safe Harbor.

This is a small village on the Susquehanna, a short distance below the mouth of the Conestoga creek, ninety-one miles from Philadelphia by the Pennsylvania Railroad (via Columbia), eighty-eight miles by the Central Division, Philadelphia, Wilmington and Baltimore Railroad (via Octoraro Junction), or ninety-three miles by the Philadelphia, Wilmington and Baltimore Railroad (via Perryville).

The hotel accommodations at this place and at all points on the Susquehanna to which reference will be made, are generally plain and substantial, ranging from one dollar to two dollars per day, and from five to eight dollars per week. The usual charge for boat and boatman is $1.50 per day, and, presumably includes bait; but the angler whose sojourn is to be brief, will do well to carry his bait with him or order it in advance. When the latter plan is adopted he is expected to pay for it.

There is good bass fly fishing in the Conestoga from the first dam to its mouth, and bait fishing for both kinds of bass in the rapids and eddies immediately opposite the village of Safe Harbor. Striped bass, ranging from half a pound to a pound and upwards in weight, are frequently so abundant here as to become a serious annoyance to those whose ambition can only be satisfied when taking the black bass. The ordinary lures are used, the principal ones being live minnows, cray-fish, helgamites, tadpoles and sometimes earth worms, when more attractive bait cannot be had. These are the predominant baits at all the places to be named, except at Havre de Grace.

Fite's Eddy.

Twelve miles below Safe Harbor, has for a number of years past enjoyed a reputation for its black bass. The water is deep and still, and the bass fishing grounds are immediately opposite the hotel. The bass are usually plentiful here, especially late in the season—the best time for taking them. The fly fishing does not succeed well, the water being too deep and quiet. Baits already referred to are the kinds used. Hotel and boatman rates as quoted.

Peach Bottom.

Or what is known as Peter's creek, nearly opposite, is another well known resort for black bass fishing. It is about four miles below Fite's Eddy, and has good hotel and boating accommodations. Many bass are taken here in the course of the season, the waters being especially adapted to them. In the still deep pools in the vicinity the largest fish are caught. Fly fishing in the rapids and eddies. In addition, large sunfish, chubs and catfish afford abundant sport when the more capricious bass are not inclined to take the bait. Good hotels; boatmen plentiful.

Port Deposit.

This is the most celebrated black and striped bass fishing locality on the Susquehanna. It is three miles from Perryville, which is on the Philadelphia, Wilmington and Baltimore Railroad, sixty miles from Philadelphia and thirty-seven miles from Baltimore. It can also be reached from Philadelphia by the Central Division of the Philadelphia, Wilmington and Baltimore Railroad. Black bass, at this place, are not only numerous but usually are large sized, ranging from two to seven pounds, and averaging from three to four. The bait in best repute here is the live mud dabbler, a small fish procured from Baltimore, to secure which orders must be given in advance. Live shrimp from the same source are also very effective; then follow the ordinary minnow, the craw-fish, tadpole and small catfish.

Early in the season trolling is most in vogue. This is pursued in the rapids, commencing a mile above and extending as far as Conowingo bridge. A float with a very light sinker, or none, is used, with four or five feet of line below the float. The waters in the vicinity of Port Deposit at times fairly teem with striped bass. At no other point in the Susquehanna are they taken with equal abundance or of as large size. A twenty-pounder is frequently hooked, though none but experienced anglers care to encounter customers of that size. No finer sport could be desired than is afforded by these gamey and beautiful fish. They are taken in pretty much the same manner and with the same bait as the black bass.

Early in the morning and from four o'clock until sundown are their best biting hours. Salted eel-tail is a favorite lure, and they are also captured by means of the spoon. When the latter is used clear water is essential to success. June and July are the best seasons at this place for both kinds of bass. The hotel accommodations are good at $1.50 per day. Boats that comfortably carry several fishermen, together with the boatman, can be had for $3.00 a day, the lessees paying for the bait.

White Perch and Moccasin.

Before bidding adieu to the Susquehanna, the fact deserves mention that there are good perch grounds in the vicinity of Port Deposit and off Locust Point, at the northern end of Spesutia Island, some six miles below Havre de Grace.

In the narrows, between Spesutia Island and the main land, moc-

casin or sunfish of large size are plentiful and readily taken. Although not generally so classified, they deserve to be ranked among the game fish, for at certain times they take the fly as readily and greedily as the trout. They are very abundant also at the edge of the channel at Carpenter's point, at the mouth of the Northeast river, nearly opposite Havre de Grace, and a few miles south of Principio station, on Philadelphia, Wilmington and Baltimore Railroad.

The Philadelphia and Erie Railroad.

The main line of the Philadelphia and Erie Railroad runs in a northwesterly course from Sunbury, Northumberland county, to the great lakes, a distance of two hundred and eighty-eight miles, through the counties of Lycoming, Clinton, Cameron, Elk, McKean, Warren and Erie. This line traverses a region of remarkably varied and most charming mountain and river scenery. From the elevated side of Kane the road descends in steep grades and penetrates some of the richest and most interesting oil and natural gas fields in the McKean district. No section of Pennsylvania affords a better field or research for the student of natural history, or, on the other hand, offers more inducements to the devotees of the rod and gun, than the territory from the great lumbering centre, Williamsport, to the busy city of Erie.

Lake Erie and Bay.

Lake Erie has an area of about 9,000 square miles. It is a little larger than Lake Ontario, but considerably smaller than the other three great lakes to the north and westward. Its length is given as about 240 miles, with an average width of about 40 miles; opposite Ashtabula, Ohio, it attains the greatest width, it is said, 58 miles. "The fisheries of the lake are of vast importance, surpassing in extent those of any other of the great lakes, or of any other body of fresh water in the world." The line of coast in our State is notable for its evenness, which is broken only in the neighborhood of Erie, where, to the southwest of the city, the peninsula (Presque Isle, or almost an island, as it is often when the water is high) runs off in a northeasterly and easterly course, "so as to almost include a body of water four or five miles long, and from one to two miles wide. As this has a depth sufficient to admit the largest vessels, it forms an excellent harbor, one of the best upon the lakes, variously known as Erie Bay, Presque Isle Bay and Erie Harbor." The miry flats adjacent to the mouth of Mill creek, a small stream which discharges its water, with

much garbage, into the bay, between the Soldiers' and Sailors' Home and the iron ore dock, are common feeding grounds for different kinds of water birds, during migration as well as other periods.

Good hotel accommodations can be secured in Erie city at reasonable rates; boats and competent boatmen may always be obtained at moderate prices. The Peninsula, a great arm extending about six miles from the main land into the lake, forms the northern boundary of Presque Isle Bay, a locality famous for its good fishing and a common resort (as noted on preceding pages) for many kinds of water birds.

Several ponds on the Peninsula, which have been sown in recent years with wild rice (Zizania aquatica, Linn.), are favorite feeding places for different species of wild ducks. Nowhere in the State, except along the Delaware river, in the vicinity of Chester, are Sora or Carolina Rails as plentiful in the late summer or early autumn as they are in those rice grown ponds. On the sand bars, muddy flats and gravelly shores, shore birds congregate in large numbers and afford excellent sport to gunners.

KANE.

Colonel Thomas L. Kane founded and laid out the town of Kane, McKean county, where he raised, in the spring of 1861, a regiment of hunters, trappers and loggers, known as the "Bucktails," which became famous for their great bravery, skill as marksmen and unusual power of endurance. Kane, ninety-five miles from the metropolis of the lake, is situated at an elevation of two thousand and one feet above the level of the sea. It is the highest point reached by the Philadelphia and Erie Railroad. Dainty and sprightly warblers and many other species of wild birds, whose showy garbs or rare vocal powers make them particular objects of interest, are abundant in the extensive hemlock and hard wood forests of this attractive resort. To the east of the town is a large tract known as the "Wild Cat Country." In this tract the tourist will frequently meet with straggling individuals, or sometimes small flocks of wild pigeons, which, until within a few years were found in countless numbers in McKean and neighboring counties.

The familiar snow bird (*Junco Hyemalis*), finds a congenial summer abode on the elevated table land where Kane is located, known as "Big Level," which constitutes the boundary from south to north of the Pennsylvania oil and coal field. A fifteen minutes' walk along the railroad, westward from the Thomson House, will lead one to a locality where the Mourning, Hooded, Chestnut-sided, Pine, and Mag-

nolia Warblers, also the sweet-voiced Olive-backed Thrush, the secretive and melodious little Wren annually rear their young. Pheasants or ruffed grouse are scarce, but squirrels are usually quite plentiful. In the early part of September, 1889, the writer saw two gunners bring in over forty black squirrels which they had shot in one day within half a mile of the Thomson House.

Emporium.

The county seat of Cameron, is 149 miles from Erie city (via Philadelphia and Erie Railroad), and 297 miles from Philadelphia by the Pennsylvania Railroad (via Harrisburg and Sunbury). The population is about 2,500. Until within a comparatively recent period, lumbering was the only important business engaged in, but now, since this industry has very appreciably decreased, in consequence of the depletion of many of the heavily wooded parts of the country in the vicinity of the town, new enterprises have sprung up and are being pushed with much vigor and success. Aside from its important lumbering interests, and numerous saw mills, Emporium has a furniture factory of considerable size, extensive powder works and a large iron furnace which give employment to a goodly portion of industrious, frugal and good-hearted citizens. The principal hotels are the Warner House, Commercial, St. Charles, City, Cottage, and Cook's hotels, where very good accommodations can be obtained at prices ranging from one to two dollars per day; or from five to eight dollars per week. The charges for livery teams are as reasonable as those of the average rural towns.

Trustworthy guides—skilled in the use of both rod and gun—who are thoroughly acquainted with every section of the country, can be hired at astonishingly low figures on application to the clerks of any of the hotels. Quail are almost unknown to the hunters of this region, but ruffed grouse or pheasants are abundant notwithstanding the fact that these noble game birds, both old and young, are destroyed in large numbers by foxes and wildcats, which are exceedingly numerous here. Rabbits are common but, like the grouse and other species of ground-nesting birds, they also suffer greatly from the depredations of foxes, wildcats and weasels. The Varying Hare, an animal which presents a curious phenomena of becoming white in winter, although attired in a brownish coat in the summer season, is a familiar and unusually fleet-footed inhabitant of the extensive laurel thickets in the mountain ridges west of Emporium.

This animal, commonly known as "white rabbit," affords capital sport when hunted with good hounds. From ten to a dozen black

bears are captured in the neighborhood of Emporium every season, according to reports received from reliable informants, but bear hunting parties in this, or almost any other portion of Pennsylvania, much oftener return home empty handed than otherwise.

Deer are quite plentiful. Mr. M. M. Larabee, a gentleman whose thirty years' experience as a collector and student of natural history has enabled him to become thoroughly familiar with the life histories of the birds and mammals of his region, says, that until within the last five or six years from one hundred and fifty to three hundred deer were killed during the season of each year. Now not over fifty of these animals on an average are annually sent to the market from this point. One fact concerning the Cameron county hunters deserving of particular note, is that they will not allow deer to be hunted with dogs (which is contrary to the laws of Pennsylvania), and, furthermore, when the shooting season is over they do not kill or permit any one else to destroy deer or other game as is unfortunately the case in some other good hunting localities out of the state. Porcupines, or, as many term them, "Hedge Hogs," are very common in the wooded districts.

The Northern Raven and Pileated Woodpecker, resident species, are frequently met with in this locality, but both are so shy that it is an extremely difficult task to capture them. Brook trout are numerous in the streams of Cameron and adjoining counties. Although many streams could be particularized by name, two, viz.; Cowley Run, about six miles from Emporium, and Cook's Run, about four miles distant from the same town, are particularly noted for the fine trout fishing they afford.

Clinton County.

Has been noted, for many years past, as a favorite hunting ground for deer, black bear and pheasants or ruffed grouse (Bonasa Umbellus). It may be reached by hunters from the eastern and western portions of the State via the Philadelphia and Erie Railroad, which traverses through the centre of the county a distance of fifty-two miles. The favorite hunting grounds are on the Scootac range of mountains, ten miles south of Glen Union station; Hall's Run, eight miles west of Renovo; Round Island, four miles west of Keating station; Hammersley's Forks, twelve miles north of Westport station; Young Woman's creek, ten miles north of Bend station. The latter two places are contiguous to the famous hunting grounds of Potter county, where there is a continuous stretch of forest lands for seventy-five miles. In 1885, according to reliable information, 2,200 deer were

killed in Clinton and Potter counties. Since then the number slain has largely diminished annually, and at present black bears are believed to be more plentiful than deer. During the winter of 1890 and 1891 several hundred bears were reported to have been trapped and killed in the western part of the county. In the same region wildcats are frequently met with, also the pine marten and fisher, but both are rare and seldom taken by hunters or trappers. The pileated woodpecker resides, during all months of the year, in this extensive and attractive wooded district. Raccoons and porcupines are abundant, but the opossum is of rare occurrence.

In the fall of 1897 pheasants were very plenty along Baker's Run, near Glen Union station; on Young Woman's creek, near North Bend station; on Sandy Run, six miles west of Renovo, and along the Susquehanna and Clearfield Railroad—a branch of the P. & E Railroad running from Keating to Karthaus, a distance of twenty-three miles in West Keating township.

The native gray squirrel is becoming scarcer every year, while on the other hand the red or "pine" squirrel is annually increasing in numbers. About the latter part of September of each year, black squirrels make their appearance in large numbers. They are migratory and their sojourn seldom lasts more than a few weeks. Hundreds of them were shot along the Philadelphia and Erie Railroad in fall of 1890. Rabbits are still plentiful in the valleys of the county, nearby Lock Haven, the county seat. Gray foxes and wildcats are numerous in the townships of Gallaher, Grugan, Chapman, Leidy, East and West Keating and Beech Creek. These sly, predatory animals are especially destructive of the farmers' poultry as well as of all kinds of small game. Foxes rarely molest the young fawns, but wildcats, from reports of hunters and woodmen, destroy large numbers of fawn annually.

Black bass were placed in the West Branch river by the State Fish Commission about ten years ago. Since then they have become abundant, and afford plenty of sport to the angler. The best places to fish for bass are at Lock Haven, Queen's Run, Farrandsville, Glen Union, North Bend, Renovo, Westport and Keating, on the West Branch, and at Round Island, Wistar and Sinnemahoning station, on the Sinnemahoning river. All the above points are reached by the Philadelphia and Erie Railroad.

Brook trout fishing has been fairly good the past season (1897). The favorite streams are Baker's Run (Glen Union station), Young Woman's creek (North Bend station), and Kettle Creek (Westport station). On account of many streams—Hymer's Run, Burn's Run, Hall's Run and others—being recently stocked by the State Fish Commissioners, fishing has been prohibited for a period of three years.

THE DIAMOND VALLEY.

Another of Pennsylvania's natural game preserves, located in the western part of Huntingdon county, is about one hundred and fifty miles east from Pittsburg, and a little over two hundred westward from Philadelphia, via the Pennsylvania Railroad (main line). For many years past this locality has been famous for game—both large and small—and in the summer months it is frequently visited by naturalists who camp out when searching for specimens. The region has a rich and varied flora and fauna, and some rare "finds" are said to have been recently made there by zoologists and botanists.

Diamond Valley is twenty to twenty-five miles long and varies from one to three miles in width. From the Juniata river—a stream noted for its fine fishing and beautiful scenery—it extends northward to the Great Bear Meadows in Centre, Mifflin and Huntingdon counties. The Tussey mountains rise to a considerable elevation on the eastern side of the valley, while to the west are the ranges known as the Broad Top mountains, where, according to tradition, cruel, blood-thirsty and heartless red men, long years ago, were wont to take their captives and subject them to tortures far more horrible than death. On these as well as other neighboring mountain ridges, white pine, hemlock and yellow pine trees grow in abundance. Oaks of different kinds are also common, especially the variety called "rock" oak.

The mountains range from about 1,000 to 1,200 feet above sea level. Brook trout are said to be abundant in Globe Run and several other of the smaller creeks of the district. Diamond Valley is readily reached from either of the following stations on the Pennsylvania Railroad: Spruce Creek and Petersburg, where good guides and hotel accommodations can be obtained. Barree, one hundred and forty-two miles from the Smoky City, is the name of another station where hunters often stop off. The following table will give a very clear idea of the

Game in Diamond Valley and Near Vicinity.

Name of Animal.	Remarks.
Virginia deer,	Fairly common, but becoming less so every year; in the season of 1890 sixty-five were killed in the Diamond Valley.
Black bear,	Frequent; five captured fall of 1890 in Diamond Valley.
Otter,	Rare.
Wildcat,	Rather numerous on some of the mountain spurs. A great destroyer of game—grouse, quail and rabbits.
Fox, red, Fox, gray,	Common; both devour much poultry and game.
Porcupine,	Tolerably common.
Raccoon,	Abundant.
Opossum,	Rare.
Ground-hog; woodchuck,	Abundant.
Skunk,	Abundant; feeds on poultry and game, as well as insect life.
Common rabbit,	Abundant.
Varying hare; white rabbit,	Found on the Bald Eagle Ridge (Muncy Mt.), a few miles west of Diamond Valley.
Squirrel, gray,	Very abundant in 1890.
Squirrel, red; pine,	Abundant; kills many young birds and drives grays away.
Squirrel, black,	Common some seasons, but rare at other times.
Squirrel, flying,	Rather scarce.
Squirrel, fox,	Very rare; two killed in 1890.
Mink, Weasels,	Abundant; they destroy much poultry and game.
Muskrat,	Abundant.
Pheasant; ruffed grouse,	Abundant.
Quail; partridge,	In 1890 were quite plentiful in eastern and central parts of Huntingdon county, especially in Harris' Valley and Smith's Valley, both south of the town of Huntingdon.
Wild turkey,	Very plenty in 1890. Saddle Ridge is best locality. Turkeys are to be found on Short Mountain, Jack's Mountain, Shade Mountain, Muncy Mountain and Broad Top Mountain.

Game and Poultry Destroying Animals.

Under the notorious scalp act of 1885, about $150,000 (estimated) were expended for different kinds of birds and mammals. This measure was passed because it was claimed that such a law would be a great benefit to agriculture, poultry and game interests of the State. After being in operation about two years it was found that the damage done through the killing of beneficial birds of prey and numerous other kinds of feathered animals, which were slaughtered and substituted for hawks and owls, was far greater than the good accomplished by the killing of these birds. In 1887 that part of the act which related to hawks and owls was repealed.

Hawks and owls collectively considered, are beneficial and should

be protected by farmers and fruit growers, as they subsist mainly on destructive mice, grasshoppers, beetles and grub worms. There are, however, some kinds of hawks, and a couple of varieties of owls, all common in Pennsylvania, which do a great deal of mischief in the poultry yard, and they also kill lots of pheasants, quail, rabbits and numerous kinds of small song and insectivorous birds. The detrimental species are known by the following names: Cooper's Hawk, Sharp-shinned Hawk, Goshawk, Great Horned Owl, and Barred Owl.

Unfortunately, when a bounty of fifty cents each was paid for raptorial birds under the act of 1885, investigations showed that only a very small proportion of destructive kinds of hawks and owls were presented for premiums. In fact, about 90 per cent. of genuine hawks and owls destroyed and offered for bounties were beneficial kinds. Through fraudulent practices and surprising and deplorable ignorance, many kinds of feathered animals, such as chickens, turkeys, guineas, pheasants, sea gulls, cuckoos, robins, butcher-birds, nighthawks, and even some English sparrows were called "hawks" or "owls" and bounties paid for them. Fraud and ignorance also aided to deplete the counties' exchequers by the substitution of different wild and domesticated animals' remains for wolves, foxes, wildcats, minks and weasels. In this way common house cats, cur dogs, young woodchucks and opossums and squirreds, red, gray, black, and fox, and chipmunks were used.

The evidence collected shows that, except in a few counties, these improper practices—wittingly and unwittingly carried on—were confined chiefly to birds. An examination of the bounty records from a number of the best counties in Pennsylvania for game of different kinds shows that under the scalp act of 1885, and as amended in 1887 and 1889, several species of animals, to wit, foxes, red and gray, wildcats, minks and the large weasel or ermine (all of which destroy game and poultry) are much more numerous than is commonly supposed, as can be seen from the following data:

County.	Foxes.	Minks.	Weasels.	Wild Cats.
Adams,	2,057	854	523	66
Berks,	612	485	210	30
Blair,	2,047	341	198	6
Bradford,	1,271	2,029	985	45
Bucks,	455	434	182	None in county.
Butler,	329	1,462	....	....
Cambria,	2,886	843	275	136
Cameron,	183	53	....	58
Centre,	4,086	860	265	252
Chester,	220	723	551	None in county.
Clarion,	2,141	428	410	43
Clearfield,	778	278	....	430
Clinton,	1,586	292	46	302
Crawford,	271	5,218	5,370	....
Cumberland,	1,876	700	283	26
Dauphin,	766	300	120	19
Erie,	181	660	890	....
Franklin,	2,912	834	102	196
Fulton,	1,472	834	163	89
Greene,	140	126	986	....
Huntingdon,	3,633	2,727	145	127
Indiana,	275	127	....	5
Jefferson,	2,016	1,695	....	270
Lackawanna,	958	838	122	206
Lancaster,	602	506	283	8
Lebanon,	299	29	47	20
Lehigh,	415	364	57	....
Montgomery,	35	75	17	None in county.
Pike,	1,116	292	59	132
Potter,	1,198	649	25	264
Schuylkill,	1,404	700	189	....
Snyder,	841	933	123	8
Sullivan,	921	403	....	224
Union,	687	507	74	30
Venango,	931	1,403	712	14
Wyoming,	742	1,196	262	75
Total,	42,292	30,448	13,684	3,081

The figures in these columns represent only a portion of the bounties paid by thirty-seven counties of this State. The counties of Allegheny, Philadelphia and Delaware paid practically no bounties for either birds or mammals under the act of 1885; all other counties however, paid liberally for this unwise measure. The records from counties other than those named above have not been preserved in such a way that the name and number of each kind of animal on which bounty was paid can be separated.

Skunks, raccoons and opossums catch poultry and devour different kinds of wild birds of both game and the song species. These animals are easily caught in different kinds of traps, and the value of their fur is such that trappers keep their numbers reduced.

Investigations of some of the best naturalists in the country show that the skunk, contrary to prevalent impressions, is of great benefit to the farmer and agriculturist, as his dietary is made up mainly of grub worms, beetles, grasshoppers and mice. Skunks are very prolific and common in numerous sections of this State. During the years 1885, '86 and '87, Centre county, under a local law, paid bounty on 3,370 skunks, and in the same years Clinton county paid for 396 of these animals.

The weasels mentioned above, were nearly all killed in a period of about 18 months, from December 1, 1885. In 1896 premiums were paid in Huntingdon county on 1,112 foxes, red and gray, and 1,341 minks, the greater portion of which were taken by one hunter and trapper. In 1886 Jefferson county paid for 950 foxes, both species,

and 798 minks. Jefferson paid no bounties in 1888, 1889 or since 1891, except on wildcats, where, on an average, about 24 are annually offered for premiums. In 1890 a bounty of ten dollars was paid in Potter county for a wolf. With the exception of a few foxes and minks no bounties were paid in Potter after 1887, except on wild cats, where, on an average, about 25 are taken each year. The records show that the county of Berks in 1886 paid ten dollars for a wolf, and in 1896 forty dollars were paid in Lackawanna county for what were believed to be wolves. Tioga county also paid for three wolves within the last two or three years, but they were prairie wolves which had been shipped from the far west, liberated and shot in Pennsylvania. Records show that Centre county paid for a panther in 1886. The scalp or bounty act of June 9, 1897, provides that the counties shall pay premiums on the following animals: Foxes, both red and gray, $1.00 each; minks, 50 cents each; wildcat or catamount, $2.00 each. The name wildcat, however, is not intended to include bob-tailed and grayish-brown individuals of the common house cat.

SUPPLEMENTARY REPORT OF DAIRY AND FOOD COMMISSIONER.

By MAJ. LEVI WELLS, *Dairy and Food Commissioner, Harrisburg, Pa.*

As work under the pure food law progresses, the number of samples sent for analysis generally decreases. This decrease amounted to over five hundred samples in 1897, as compared with 1896. It should not be inferred from this that our agents are less active or vigilant, for, on the contrary, they are more so. This result arises from the fact that but few adulterated goods are now found on our markets as compared with former years, and because, after careful examination, and preliminary tests made by our agents, only suspicious samples are sent for analysis. The following tabular statement explains this subject more fully:

	Number of samples not found to be adulterated.	Number of samples found to be adulterated.	Total number of samples.
Apple jelly,	1	1	2
Apple butter,	1	..	1
Allspice,	5	3	8
Black pepper,	23	21	44
Beer,	1	..	1
Blackberry brandy,	..	1	1
Butter,	276	"oleo." 333	609
Canned pumpkin,	1	1	2
Chicken soup,	..	1	1
Chocolate,	6	2	8
Cream ripener,	..	7	7
Cider vinegar,	23	2	25
Cayenne pepper,	3	2	5
Cinnamon or cassia,	7	3	10
Cloves,	2	3	5
Coffee,	6	10	16
Catsup,	6	15	21
Cheese,	17	low in fat. 3	20
Cream of tartar,	20	10	30
Cocoa,	5	3	8
Canned peas,	..	1	1
Extract of vanilla,	..	1	1
Ginger ale,	..	1	1
Ginger,	15	5	20
Ham,	1	..	1
Honey,	5	2	7
Jelly,	1	..	1
Lard,	6	3	9
Mustard,	20	18	38
Mince meat,	5	3	8
Olive oil,	12	9	21
Preservaline,	..	2	2
Salt,	..	1	1
White pepper,	..	4	4
Total number of analyses in 1897,	....	....	939

THE CONSTITUTIONALITY OF THE LAW.

The constitutionality of the pure food law is again attacked in Chester county. They were reversed by the higher court in their former ruling upon the unconstitutionality of the act from alleged defective title. In the present instance, their attack is on section four of the act, which reads as follows:

"Section 4. Every person manufacturing, offering or exposing for sale or delivering to a purchaser any article of food included in the provisions of this act, shall furnish to any person interested or demanding the same, who shall apply to him for the purpose and shall tender him the value of the same, a sample sufficient for the analysis of any such article of food which is in his possession."

ANTISEPTICS.

What to admit and what to exclude in the way of food preservatives, has been a question somewhat difficult to decide. As seasons come and go, so do many delicious fruits, and to properly preserve, and to keep them in a healthful and convenient form for use during seasons when we do not have them fresh, has become a study and almost a science upon which manufacturers have spent much time and money. Meats also have, for convenience and transportation, to be preserved, as well as vegetables.

Salt, sugar, alcohol, vinegar, spices and other articles have long been in use for preserving various kinds of food products. These, however, all affect in taste, or otherwise, the product in which they exist, thus making their presence known. In recent years, other antiseptics have come into frequent use, whose presence does not affect the taste or odor of the various foods in which they exist, and their use can only be determined by chemical analysis.

Salicylic acid, benzoic acid, boric acid and various other substances were in common use to prevent fermentation in various foods and drinks. Much has been written for and against the use of these articles in food products, and the general verdict has been that some, at least, were extremely harmful, and being deleterious to health, were in violation of the pure food law. Salicylic acid is more generally condemned than others on the list, and against the use of this we have

strenuously objected, as being injurious to health in the quantities it is liable to be used. The fact that it can be used in large quantities without its presence being detected by taste or smell makes it more dangerous.

Benzoate of soda, Dr. Leffman pronounces comparatively harmless in quantities that it can be used without its presence being detected by the taste. As fermentation is prevented by its use, we have, in this substance, an article well calculated to supplant the use of salicylic acid, not possessing the dangerous properties of the latter substance. Borax and boracic acid in quantities used as food preservatives, if at all harmful, are so in a much less degree than salicylic acid.

REPORTS OF AGENTS.

PHŒNIXVILLE, PA., January 1, 1898.

MAJ. LEVI WELLS, *Dairy and Food Commissioner*,
HARRISBURG, PA.

Sir: I have the honor to submit the following review of my work from January 1, 1897, to this date, in the following named counties, included in my territory, as prescribed by the Department, viz: Berks, Montgomery, Bucks, Carbon, Lehigh, Monroe, Northampton, Pike and also Luzerne and Lackawanna counties.

During the time named, I have visited 1,836 stores, 94 creameries and have attended court and hearings before justices of the peace in ten counties. As a result of these visits to the several stores and creameries, I have collected 205 samples. Only suspicious samples were sent: thirty-four of this number have been returned by the chemist as good, and the balance, 171, were not good, an average of 85 per cent. of adulterations. Of the samples taken, 27 were in Berks, 14 in Lehigh, 9 in Carbon, 15 in Northampton, 11 in Bucks, 29 in Monroe, 27 in Pike, 45 in Montgomery, 19 in Luzerne and 9 in Lackawanna counties. Of this number, 36 were vinegar, 21 black pepper, 19 coffee, 35 yellow mustard, 14 cream of tartar, 29 butter and the balance were different articles, including all kinds of spices, honeys, jellies, mince meats, syrups and, in fact, almost everything sold as food in the several groceries.

Of the 36 vinegars taken, only 2 were as represented; of 21 pepper samples, 4 were pure; of 35 yellow mustard, 5 were pure; of 14 cream of tartar, 2 were pure; of 19 coffee, 4 were pure; of 29 butter, 11 were pure. The balance of samples were in about this proportion.

As a result of the collection of the above goods, and including 64 samples previously taken, from September 26, 1896, to January 1, 1897.

there have been several prosecutions, most of which were settled before the justice. Some have been bfore the courts, and the balance are still pending. The Department, as a rule, has been successful, except where there have been technical points or questions of law raised by the defendant's attorneys, some of which have been overruled.

The total amount of fines, analyses and costs was $1,583.78, of which was collected for oleo, $530.78, and paid to counties, account of oleo fines, $200.00, and for pure food cases, $1,053.00.

The oleo fines were all collected in Luzerne and Lackawanna counties by me, with the exception of $100.00 from Lehigh county. As my record of cases also includes the work from September 21, 1896, a portion of the above amounts for fines, etc., is in connection with them.

The most of the pure food fines were for adulterated vinegar, coffee and yellow mustard; the balance were from various other goods.

During the time from January 1, 1897, to the present date, there h ve been questions raised as to whether mustard was an article of food. As the courts have refused to make a ruling, the question is still undecided as to whether it is or not.

There are still several cases before the different courts in the several counties under the pure food law, and also for selling oleo, which will be adjusted as soon as they can be reached. And, as stated before, the Department has been successful in most of the cases, and has not been called on to pay any costs in the suits which have been negatived.

I desire to call the attention of the Department to the adulteration of butter by many creameries in various counties surrounding Philadelphia. Thes creameries were using an article known as "cream ripener," composed of cotton-seed oil and cotton-seed stearine, which, by actual test made by the chemist, showed an increase in the weight of butter of about 20 per cent, over its own weight by taking up the casein and milk residue. The use of this composition was clearly a violation of the oleomargarine and pure food laws. After much labor and expense, the agents of the Department have practically broken up this business. Some of the manufacturers who have persisted in using the ripener have been arrested.

Next in interest to the consumer, and equally as important, was the wholesale adulteration of spices, which were being foisted upon the public by unscrupulous persons without regard to the laws of the State or the health of their victims. The recent finding of 5,600 pounds of this class of goods stored in a livery stable and the arrest and fining of the persons who were responsible for the goods being in that locality, with the imprisonment of the manufacturers by the United States Government, has, I believe, practically broken up at least one branch of manufacturing fraudulent goods.

This lot of goods, which consisted of eleven different varieties, has

been reported by the chemist as the worst he has ever analyzed, some of which were dangerous to the health of the persons using them.

Prior to the enactment of the law regulating the sale of vinegars, which was passed in June, 1897, there were very few violations, but since the said law has prohibited the sale of colored vinegars, there will be more or less goods sold that will not be in compliance with its provisions. In my opinion, with a firm and respectful stand taken by the agent, and the co-operation of the jobbers and retailers, it can be enforced without serious inconvenience or loss to all concerned.

In regard to the enforcement of the new cheese law, regulating the sale of cheese, I am glad to say that not only the retailers, but the manfacturers and jobbers are willing and anxious to co-operate with the agent in its enforcement.

I also desire to call the attention of the Department to the large decrease in the sale of adulterated foods of all kinds since the enforcement of the laws, which in my judgment is not more than 25 per cent. of what it was two years ago.

There are a few exceptions, but in the majority of cases, the agent has been treated respectfully and with due consideration by the merchants, and, as they find that the agent's mission is not one of persecution, but only to enforce the protection of themselves and their customers, they become good friends, (even in cases of prosecution) and gladly co-operate with the officer and take his advice to buy a purer class of goods, and demanding a guarantee from their jobbers to comply with the pure food laws of Pennsylvania.

While the laws were at first unpopular with many, the objections, to a certain extent, have been largely removed since the press and the people have become familiar with the object and working of the pure food laws, and have been shown the large quantities of adulterated goods they have been compelled to buy through unscrupulous manufacturers and dealers.

At the present time the law is being sustained by the general public and by the press, when carried out in proper spirit and management.

It has always been my aim in every instance to not only explain the laws, as I understand them, but in pamphlet and circular form, with the request that the merchant carefully peruse them and communicate with me relative to any portion of the same that was not clearly understood by him, so that I could explain the matter to him or confer with the Department regarding it, as the case demanded. While this has caused extra work and expense, it has, in my judgment, been productive of a vast amount of good. The recipients greatly appreciate the work of the Department and its agent in thus interesting themselves in their behalf.

Please accept my thanks for the many courtesies and advices I have received from yourself and from the Secretary of Agriculture.

These kindnesses have greatly encouraged me to do the work required as an agent of the Department as far as I am capable and as I have understood it.

ROBERT M. SIMMERS,
Special Agent.

PITTSBURG, PA., January 1, 1898.

HON. LEVI WELLS, *Dairy and Food Commissioner*,
HARRISBURG, PA.,

Sir: I have the honor to submit the following report of my work for the year 1897:

During the year, I visited the following named counties, and in order as they appear, canvassing only the county seats and the larger towns: York, Adams, Cumberland, Franklin, Fulton, Dauphin, Perry, Lebanon, Warren, Northumberland, Snyder, Lancaster, Lackawanna, Allegheny and Beaver.

The merchants of the five first named, seem to lead all others in their desire to comply with the requirements of the pure food act. Nearly all demand from the wholesale dealer, manufacturers, jobbers and their agents a written or printed guarantee that the goods sold are pure, or, if a compound, lawfully labeled.

Perhaps one hundred groceries have been diligently searched for impure goods, and from the whole number, but three or four fell below the standard required.

In this particular part of the State, oleomargarine seems to have neither advocate nor friend, as a careful inquiry reveals no traces of it whatever.

While but little time has been devoted to Perry, Lancaster and Lebanon, the stores visited and samples taken warrants the belief that a vigorous enforcement of the law would reveal a kind of crookedness not conducive to good health.

The Alden Vinegar Company, of St. Louis, Mo., found Pennsylvania a very profitable field for their product, and especially so in the central and eastern portions. This vinegar is made from corn, but was generally sold by their agents as a pure cider vinegar, and at prices so low that farmers could not successfully compete. The result was that the latter, in some instances, began to add water and in other ways adulterated their product until it became a difficult matter to find a good quality of cider vinegar anywhere in that part of the State. Many fines were paid by both the merchant and farmer, and that, too, on the information alone of the agent before a magistrate, the defendants not wishing the notoriety that a public hearing or trial in court might give them.

Other unwholesome and adulterated vinegars were frequently found, but active work, under direction of the Department, has succeeded in limiting its sale in a marked degree.

Harrisburg became quite noted for the sale of oleomargarine and other unlawfully adulterated foods; but the payment of a few fines upon information being made, seemed to have the desired effect, the sale of oleomargarine having ceased entirely, and that of others satisfactorily regulated.

In Warren county, but little work was done, but sufficient, however, to show that oleomargarine was sold to a limited extent by a non-resident in original packages of ten pounds or more. This non-resident resided near Jamestown, New York, and once a week visited Warren, where he found but one merchant willing to engage in the sale of oleo. One sample taken, proved, on analysis, to be oleomargarine, and an investigation led to the conviction of the non-resident peddler, both in the United States court, for violation of the revenue laws, and in the New York courts for selling oleomargarine as butter, while the case against the merchant is still pending.

A few samples of adulterated spices, extracts, etc., were taken, but this was the exception, and not the rule, as the merchants were found to be well informed as to the law and largely in favor of its enforcement.

In Snyder county, but one person was found engaged in the sale of oleomargarine, who readily plead guilty to the information made, paid the fine imposed and declared he would never again engage in the business.

My time here was so limited that I could not fully examine the stores for impure foods, but am satisfied that merchants generally are complying with the requirements of the act, and that the party above referred to was the only one engaged in the sale of oleo.

In Northumberland and Lackawanna counties, merchants, hotel keepers and proprietors of boarding houses and restaurants were found to be engaged in the sale and use of oleomargarine and on being informed of the fact, would generally enter the plea of innocence. I do not mean by this that the traffic was general by any means, for, on the contrary, but very few of the many engaged in the butter business could be found selling, aiding or abetting this unlawful practice.

Pittsburg, in Allegheny county, and a few adjoining towns, seem to be the only sections of the State where oleomargarine is publicly sold and the law defied. Within the last five months, I have secured something over 200 samples, all of which, with two exceptions, were sold as butter and ranging in price from fifteen cents to twenty-eight cents per pound. Civil writs were first issued in all these cases brought, and in some instances, where a second offense was committed, criminal action was brought. Judgment for $100 and costs were entered by the several aldermen in every case, save two or three, where the evidence appeared to be insufficient, or the wrong party summoned or named in the writ. An appeal was taken in most of the civil cases

and is now filed in argument court, where a decision will soon be reached.

In ten cases, no appeals were taken, but fines and costs paid over to the alderman immediately after the hearing and judgment.

All of the criminal cases, sixteen in number, were taken to court, and were ignored by the grand jury, with costs placed upon the county.

There are yet eighty-five cases to be heard, in which no action has been taken.

From a large number of samples taken in Beaver county, but three proved to be oleomargarine, and from this and reports received of its former sales, I reach the conclusion that its sale is nominally a thing of the past.

In conclusion, I will say that much has been accomplished during the year. The determination of merchants generally to adhere strictly to the guarantee plan of buying goods, the various organized pure food societies added to the special effort of the Department, through its agents, have succeeded in wiping out nearly all the low grade and adulterated spices, canned goods, vinegars, etc., and have largely reduced the sale of oleomargarine.

Respectfully submitted,

JAMES TERRY,
Special Agent.

WARRIORSMARK, PA., January 1, 1898.

To MAJOR LEVI WELLS, *Dairy and Food Commissioner*,
HARRISBURG, PA.

Dear Sir: I beg to report as follows:

In quite a number of cases, especially in country stores, they do not fully understand the workings of the pure food law. When explained, they are in full sympathy with the workings of the Department.

I find that in some places oleo is bought outside of the State, and used by private families. I firmly believe that if all our daiymen and butter makers would try to make a better quality of butter, the oleo law would not be so difficult to enforce.

I find that adulterated goods are not being sold as they were one year ago, as, in a county where I took twenty-five samples of cider vinegar, only two of that number were cider, and they were below the standard. I believe that 75 per cent. of vinegar sold as cider vinegar was not cider vinegar prior to the enforcement of this law.

In another instance, 180 barrels of vinegar were shipped into this State, branded and sold as "cider vinegar," and, after being analyzed by our chemist, it was discovered that it was not cider vinegar. I could give similar instances regarding other articles of food.

In Erie city, Erie county, I settled up three cases of oleo, the defend-

ants paying the fines and costs. One case of selling oleo, under the order system, but made a direct sale to me; prosecution was brought against him, and after consultation with the Department, the case was directed to be settled, with defendant paying all costs and to quit the business, which he did.

One sample of coffee was taken which was adulterated with bark and a woody substance; also, one sample of olive oil, which was found to be adulterated with cotton-seed oil. The merchant paid all costs in these cases. I also found, in a spice mill, that they had been grinding peas and buckwheat hulls with pepper; they also added terra-alba to cream of tartar. After paying a fine on the cream of tartar sold, which they thought could be sold as a compound, and after finding out the requirements of the law on spices, they are now grinding out pure spices, and also had a $100.00 guarantee put on each package for purity, etc.

Corry and other towns were visited; found it unnecessary to collect any samples at this time. It was reported to me that one hotel was using oleo. I went to the hotel and took a sample from the table; after being analyzed, it was pronounced to be butter.

Venango County—Franklin and Oil City visited, and some smaller towns. I found it unnecessary to take any samples. Some of the merchants were in doubt as to how some articles should be labeled in compliance with the law. I explained to them the law and workings of the Department.

Crawford County—Visited Meadville and some smaller places. All cheese on sale was branded in compliance with the new cheese law, and all articles of food were properly labeled; did not find it necessary to take any samples for analysis.

Jefferson County—Punxsutawney stores were visited. Two samples of cream of tartar were taken; one was adulterated with terra-alba; the other contained no cream of tartar. Two samples of so-called "cider vinegar," guaranteed by the manufacturer to be cider vinegar, upon analysis, were found to contain no cider vinegar. At Lindsay, one sample of cider vinegar taken; chemist reported, "not cider vinegar;" also found some spices labeled "compound." At Reynoldsville and other smaller towns, no samples were secured. At Brookville, one sample of cream of tartar was taken and found to be pure. At Falls Creek, I obtained one sample of cider vinegar, which proved to be genuine; one adulterated sample of cream of tartar.

Clarion County—Visited only a part of this county; found the merchants complying with the law, and appreciating its workings.

Warren County—The merchants are selling groceries properly labeled, in compliance with the law.

Forest County—Tionesta visited and found it unnecessary to take samples, as the merchants were complying with the law and anxious to have the same fully explained.

Cameron County—In this county one fine was collected on adulterated cream of tartar, which only contained 12 per cent. of cream of tartar, the balance being terra-alba. I have reason to believe that some party had sold, to merchants in this county, oleomargarine, billed and sold for butter; there were two packages sold. It was shipped from Williamsport; did not think the merchant was to blame in this case, as he was greatly surprised when he found the article was oleo, and stated he would not have it in his store under any consideration.

JOHN R. LEHMAN,
Special Agent.

ROLAND, PA., January 1, 1898.

HON. LEVI WELLS, *Dairy and Food Commissioner*,
HARRISBURG, PA.

Dear Sir: I beg to submit to you a brief report of my work as special agent of the Dairy and Food Department.

Beginning in March last, over three months of this time has been consumed in assisting an agent of your Department in Luzerne, Lackawanna and Schuylkill counties, covering a large and thickly populated territory. It would only be making a repetition of his record were I to report the conditions found there, consequently will leave that for the special agent in charge of that district.

At the close of the present month, I will have visited, with two or three exceptions, all the larger and most important towns and cities embraced in a district extending from Bedford county, on the south, to McKean, Potter and Tioga counties on the north, comprising twelve counties, the larger part of which is chiefly agricultural in tendency.

During the first canvassing of this territory, I found quantities of impure articles of food in the hands of reputable merchants, who were ignorant of the facts and indifferent to the laws that govern them. Adopting the view laid down by the Department to use no harsh and unfair means, I accepted their promises to return them to the original dealers. Therefore, I have but few samples taken with a view of prosecution, reserving proceedings of this nature for the future.

In dairy products, I have to report but two localities selling or dealing in imitation butter, which I have found up to this time. I have imposed the fines and collected it in one case. The second will be prosecuted in the near future. I am pleased to say, I have found all reputable dealers and the good class of citizens in every quarter, appreciating the work of the Department, and who stand ready to give it their cordial support. My contact with the farming community has demonstrated beyond a doubt their hearty co-operation in all the various divisions of the Agricultural Department.

As the work progresses, their chief competitor in dairy products, "oleomargarine," is being reduced to a minimum throughout the State, and they anticipate great results for themselves as producers, and fair dealing for the consumer.

H. R. CURTIN,
Special Agent.

DAIRYING.

The future prospect for dairying is a subject that has been much discussed, and one upon which there is a great diversity of opinion.

In this, as in many other industries, it will, in my opinion, eventually resolve itself into a "survival of the fittest," and the sooner dairymen disabuse themselves of the idea that anything made from milk in the shape of butter, no matter how poor its quality, is bound to sell, the better off they will be.

It is quite certain that strictly first-class goods will be wanted at remunerative prices, and it is equally true that inferior goods are not wanted at any price, so long as desirable goods can be obtained.

All economic questions are now world wide. We cannot hem ourselves in and make calculations or form deductions from local standpoints.

The productiveness, as well as the markets of the world, are now almost on a common level. Australia, New Zealand, Ireland, Denmark, Switzerland, France, Canada and the United States are competitors for the English market. It is simply a question of quality and cost. Quality is the first consideration.

Oleomargarine, in countries where its sale is not restricted, almost wholly takes the place of low-priced butter. One factory, near London, turns out 2,000,000 lbs. a month, which is more than half the amount of all that is manufactured in the United States. This, and the product of other factories in England, supplies the working classes of that country, hence, there is no demand there for low-grade butter for table use. The demand for such butter comes only from confectioners and bakers.

Our Secretary of Agriculture at Washington, is doing a commendable work in seeking to establish, on a firm basis, an English market for our surplus butter. But Pennsylvania, so far as dairying, or, more especially as relates to the manufacture of butter, will have to be up

and doing, and be satisfied only with the highest attainments, or our neighbors of the Western States will continue to lead in the production of high grade butter in the future, as they have in a few years past. There is no good reason why this should be so, and I hope that the creamery and dairymen of our State will resolve not to take second place with any locality in the production of fine grade butter.

We have facilities here for making the best of butter, and if we do not do it we have only ourselves to blame.

The work done at State College in the short dairy course, is a step in the right direction, and it is deeply to be regretted that they, through lack of an appropriation, have only facilities to accommodate half the young men who seek admission to this short and practical dairy course. They need more room, and an appropriation to build a modern creamery, complete in all its details, with sufficient room to accommodate at least one hundred students, would be money well expended. We can not have too many good butter makers in our State.

The problem does not, however, end here.

A good butter maker can not turn out gilt edged goods unless the material he has to work with is up to the same standard of perfection.

Producers of the milk that supply our creameries must be on the look out.

We are living in a fast age, and must get out of old ruts. Dairymen must study bacteriology and become acquainted with our unseen friends and foes, and learn to make conditions favorable for the former and unfavorable for the latter. In fact, they must realize that bad flavors are imparted to milk and cream by harmful bacteria, and that when once they are colonized and begin to multiply in a quantity of milk, that the fate of that particular batch is sealed beyond redemption.

They want to learn that milk, as drawn from the udders of healthy cows, after the teats are first emptied, is entirely free from bacteria, and that all this harmful contamination comes from the surroundings, namely, the air, dirty hands, dirty milk vessels, dirt from the cows udder and body, dirt from the milker's clothes, etc., etc.

A sure way to have your milk impregnated with harmful bacteria, if it is in the winter season, is to go out to the milking stable, and as is very generally practiced, the first thing throw down from the mow, a lot of dusty or, may be, musty hay, or ensilage, then give the hay a second forking over and feed the cows, filling the air with dust; then, in a slovenly way, go on and do the milking, taking no pains to clean the cows or your hands or clothing.

Under such conditions, before your milk is set for creaming, or before it can get to the separator, you are bound to have enough harmful bacteria colonized in it to utterly ruin it for high class products.

On the other hand, if the dairyman will see to it that every vessel with which his milk comes in contact is scrupulously clean, and ster-

ilized with boiling water or steam; that his stables are well constructed and ventilated, so that the air is pure and wholesome; that he does his milking before he has contaminated the air by throwing down dusty feed; that the cows' udders are clean; that his own hands and clothes are clean,—then, under those conditions, his milk will have a good flavor, and will produce, if properly handled, a gilt-edged quality of butter.

Here are two ways; one wrong, the other right. It is of little or no more trouble to follow one than the other. It does not cost a cent more to do it in the right way than the wrong. The right way, if followed up, will result in profit; the wrong way will result in loss. Dairymen of Pennsylvania, which will you choose?

Dairymen have two dangerous counterfeits to contend against—oleomargarine and boiled or process butter. I say they are dangerous counterfeits because usually they go to the consumers as genuine butter, and they supply the place of so much of the genuine article.

Against the sale of oleo we have the prohibitory law in this State. If boiled, or process butter were required to be sold for what it is, its sale would be greatly restricted, for few people, knowing its history, would care to use it.

To a great extent we have to accept conditions as we find them so far as markets are concerned. Dairymen practically have little control over them. They do, however, have complete control over production, and this is the end they can most successfully work upon.

The low prices prevailing for dairy products are largely due to an over production; the area of territory devoted to this industry is being rapidly extended. Only a few years ago states west of the Mississippi did not produce as much butter as they consumed, while now, Iowa produces more than any other state in the Union. There are over a hundred creameries in North Dakota, when a few years ago there were none. In the Southern states, too, creameries are rapidly multiplying, as well as on the Pacific coast.

It may be asked, is there any remedy for this over production? I will say yes, a very effective one, if dairymen will only apply it, and that is to cull out and fatten and sell to the butcher all unprofitable cows. This would take nearly one-third of all the cows kept in the United States, and it would put our dairy interests on a firm and profitable basis for years to come.

A cow that will not produce two hundred pounds or over of butter a year, is not worth keeping for dairy purposes.

Let us, as dairymen, take hold of our end of the business and think, and act, and work in every way possible to reduce the cost of a pound of butter, and realize a fair profit on its manufacture by keeping only good, profitable cows, and studying the feed question.

Dairymen who have no silos should build them. There is no feed so economical as good corn ensilage and clover hay, supplemented with

wheat bran and gluten, or cotton-seed meal fed in proportions to give a well balanced ration.

The one object to be accomplished is to produce the highest quality of goods at the lowest cost. Do this and fair profits will invariably follow.

I will append a number of articles from eminent authorities on practical dairy subjects.

WHAT CONSTITUTES GOOD MILK?

Prof. Voorhees, of the New Jersey Station, in answering this question, has the following to say:

"Good milk possesses, first, purity; that is, freedom from foreign matter; second, richness, or a high content of nutritive matter.

"The purity of milk depends chiefly upon the health and care of the cow, the character of the food used and the method of handling the product. It is impossible to secure pure milk from ill-kept animals, and ill-kept animals are less likely to be healthy than well-kept ones. The food used, which includes water, must also be good. Milk from cows fed partially-decayed, or even musty, foods, will possess bad flavors, and will sour rapidly, and impure water may not only contribute undesirable taints, but also disease germs. Milk should, therefore, be drawn from healthy, clean,. well-fed cows, by clean milkers, into clean utensils and immediately cooled and aerated, after which it should be put into clean vessels and kept cool. A dirty stable, a pail not perfectly sweet, a bottle improperly washed, a dairy-room that is illy ventilated, in which the milk is cooled or stored, may each contribute something which decreases the purity and, hence, the value of the product as an article of diet. The encouragement of cleanliness in the production of milk would be greatly increased, if consumers would occasionally visit the dairies from which they are supplied.

"The richness of milk depends largely upon the cow, her breed, her age and her period of lactation. It is believed that milk, which contains 4 per cent. of fat, is better adapted for direct consumption in raw state than either a poorer or a richer product, yet whole milk will vary widely from this standard, due to the causes mentioned. Breeds like the Holstein or Ayrshire, for example, are noted for their large yields rather than for the richness of their milk, while the Jerseys and Guernseys are noted for the richness of their milk rather than for their large yields. The milk of the former frequently shows as low as 3 per cent. of fat, while that of the latter often contains as high as 6 per cent. of fat. The fat content is a safe guide as to nutritive quality; hence, the 6 per cent. milk would furnish practically twice as much nutritive matter as the 3 per cent. It has been shown that variations in composition as wide as those here noted do actually occur in the milk, as delivered to consumers in our towns and cities, and, hence, that the cost of nutrients is much lower in rich milk than in poor milk."

Cattle Ties and Stables.

Henry E. Alvord, of the United States Department of Agriculture, in writing of cattle ties and stables, gives the following advice:

"From the great variety of cattle ties one should be selected which combines, in greatest measure, freedom of movement, comfort and cleanliness. There are serious objections to all stanchions. If some form of this device is insisted upon, let it be one which is so hung as to move a few inches in any direction. A desirable substitute for a stanchion is a wide strap or light chain around the neck, with a ring at the throat (this part to be always worn by the cow), and a snap, with a few links of chain, attached to an iron ring, which moves freely upon a three or four inch post, fastened upright at the middle of the side of the feed box next to the cow. An excellent patented device consists of a flattened bow of metal or wood, shaped like a widely spread letter U, the highest ends hinged at the front corners of the feed box, the bow resting on the back edge of the box and the neck strap fastened to this bow at the middle; this gives much freedom of movement and causes the animal to move backward a little when it lies down and forward when it rises. An open, level feeding floor in front of the cows seems to be better than any form of boxes. If boxes are used, they should be as large as possible, and yet have every part within reach of the cow as tied, and they should be so constructed as to be easily cleaned. A manure gutter behind the animals aids in cleanliness, but, while it should have good width, from sixteen to twenty-four inches, it should not be too deep; if enough to hold the droppings of a night, that is sufficient. 'Self-cleaning' stalls and gutters have not proved successful.

"The length of stall, from fastening to gutter, should suit the size of the cow; it is bad practice to have them so long as to induce filthy udders and legs, and also to have them so short that cows stand habitually with hind feet in the gutter. Arrangements should be convenient for removing the manure and for supplying absorbents for the urine and a limited quantity of bedding. Liberal use of land plaster about the gutters and the floors over which the cattle pass, is very desirable as a disinfectant, and conserver of ammonia. Lime should be used with equal freedom, as white wash on the walls of the cow house, but not on its floors.

"The stable should be provided with windows to admit light and air abundantly, and arranged to let sunlight during some hour of every clear day, into every portion of the apartment where the cows stand. The windows should be shaded, however, when desired, and should be fixed to open partly without subjecting the cows to direct drafts of air."

Dairy Records.

In referring to the value of regular tests of the milk and butter products of the dairy, Henry E. Alvord, of the National Department of Agriculture, writes as follows:

"Such records are far more easily made than the description may indicate, and are well worth all they cost. They form the only accurate and safe basis for judging of the individual merits of the different animals. The improvement of every herd, which should be the constant aim of its owner, depends upon periodical culling and getting rid of unworthy members. No one can afford to do this upon guesswork alone. One well authenticated example of the value of keeping such record follows:

"A dairyman of wide reputation, president of a State association for years, concluded to adopt the daily milk record, rather because of those who advocated it than from any conviction of needing it himself. His herd was of his own breeding; he had handled every cow from birth, and he and his sons did the milking. Before beginning the record, he made note of the joint opinion of himself and sons as to the half dozen best cows in the herd, and an estimate of their season's milk yield. When the year's record was completed, it was found that in order of actual merit, the cows actually stood thus: First, his fifth; second, a cow not on his merit list; third, his fourth; fourth, his first; fifth, his sixth; sixth, like the second, and his second and third still lower on the list. These facts were verified by subsequent records. Still more remarkable, this experienced owner proved literally 'by the book' that about one-fourth of his cows were being kept at an actual loss, while the others barely paid their way.

"Good judges believe that in the entire country one-third of the cows kept for milk do not pay for their cost of keeping, and nearly a third more fail to yield an annual profit. As a matter of ordinary business prudence and a condition essential to best results, every dairyman should study the individuality of his cows, keep a sufficient record of the quantity and quality of the milk product, know approximately the cost of production, and systematically weed out the herd. After proper consideration and practical tests as to possibilities, set a standard for a satisfactory cow, and maintain this standard by promptly disposing of the animals which fail to attain it, unless reasonable excuse appears, with the prospect of better conduct in the future, and gradually but persistenly raise the standard."

Advantage of Short Dairy Courses.

Prof. R. A. Pearson, of the National Department of Agriculture, in referring to the advantages which may be gained by the short dairy course at our Experiment Stations and Colleges, gives the following

examples of direct pecuniary gains from knowledge thus acquired at a very slight cost:

"A young man who had spent all his life at ordinary farm work and had very little knowledge of dairy methods, took a ten weeks' creamery course, and it its close had obtained a position in a creamery paying $50.00 a month for ten months in the year. Before taking the course, he had been getting $25.00 about eight months each year. Fifty dollars covered his entire expense at the school and by the outlay of this amount he more than doubled his income. The next winter, he returned to the dairy school, heard the lectures a second time, repeated a part of the work and took some advanced studies. He then secured a position which paid him $55.00 per month with house rent free. The creamery of which this young man had charge, has a neat and tidy appearance. He is agreeable to patrons and has the reputation of being the best creameryman in the community.

"A man about thirty years of age had spent his life at general farm work. He decided to learn butter making and took a short creamery course, at the completion of which he became helper in a creamery at $27.00 per month. The next year he was butter maker in another creamery at a salary of $50.00 per month, and the next year, with one helper, he took charge of a large plant at a salary of $60.00 per month and free house rent. The beginning of this improvement was a determination to excel in dairy work, and the first act was to attend a short dairy course which cost, in all, about $50.00.

"A young man, who had just finished school, attended a three months' dairy course at a total cost of nearly $70.00. The next summer he took full charge of a creamery, receiving 12,000 pounds of milk a day, and, besides making the butter, kept the books and apportioned the payments on the basis of the butter fat delivered. His butter was awarded both first and second premiums in a close contest at the county fair. He was paid $65.00 a month. The next year he took full charge of a large creamery, producing almost a ton of butter a day, and had three assistants; salary, $80.00 a month."

The Babcock Test.

Prof. F. E. Farrington, of Illinois, gives the following plain and explicit directions for operating the Babcock test for butter fat:

"1st. An acid having 1.82 specific gravity should be used with milk at 60 to 70 degrees Fahrenheit. If the acid is stronger, cool the milk to a lower temperature. Somewhat weaker acid can probably be made to work all right by warming the milk.

"2d. When measuring the acid into the test bottles, hold the bottle at an angle that will cause the acid to follow the inside walls to the bottom of the bottle, and not drop through the milk in the center of the

bottle. If properly poured into the test bottle, there will be a distinct layer of milk and acid, with little or no black color between them.

"3d. Thoroughly mix the milk and acid as soon as measured into the test bottle. A better separation of fat is obtained by mixing at once, than by allowing the two liquids to stand unmixed in the bottle until enough tests have been measured to fill the centrifuge.

"4th. After five minutes of whirling of the test bottles in the centrifuge, add hot water until the test bottle is filled to the neck only; run the centrifuge one minute, then fill the neck of the test bottle with hot water and run the centrifuge another minute. Adding the necessary hot water in two portions is often a great help in getting a clear separation of fat. When the test bottles are taken from the centrifuge, they are put into water at 140 to 160 degrees Fahrenheit, and the per cent. of fat read at that temperature.

"5th. Too low results will be obtained if the centrifuge does not have sufficient speed. The machines have to be watched, as constant use wears some of them so that the speed designed by the manufacturer is not obtained.

"6th. When testing skim-milk and butter-milk, which have a very small per cent. of fat, two-thirds of one per cent., or less, the reading of the per cent. of fat should be made immediately upon taking the test bottle from the centrifuge. If this is not done, and the test bottle cools off before taking the reading, the contraction of the liquid in the bottle will often leave the fat spread over the inside surface of the measuring tube, so that it is not seen, but has the appearance of being only a dirty tube. If read when taken from the machine, the small globules of fat can be seen and estimated."

Causes Which Affect the Quality of the Milk.

Many consumers of milk in our larger cities appear to be of the opinion that there is practically no variation in milk, and that the article delivered by one milk man, or given by one cow, is just as good as another, and when told of the ranges of variation which are possible are inclined to doubt the correctness of the information.

In referring to these variations in quality, Prof. R. A. Pearson, of the National Department of Agriculture, writes as follows:

"These constituents vary between wide limits, as to the total solids of milk may be as low as ten and as high as eighteen parts in one hundred. The fat (cream) varies in quality more than any other part of the milk, running as low as two parts in one hundred and as high as seven; the larger the proportion of fat, the richer the milk."

We may, for all practical purposes, assume that the following fairly represents average milk, which has neither been watered nor skimmed:

Fat,	3.75
Casein,	2.50
Albumen,	0.70
Sugar and organic matter,	5.15
Ash,	70
Water,	87.20
	100.00

There is a common theory that very much of the composition of the milk depends upon the character and kind of food made use of. On this phase of the question, Dr. S. M. Babcock, writes as follows:

"There is a widely prevalent notion among practical dairymen that it is possible, by selecting the kind of food, to increase or diminsh at will the per cent. of fat in milk to a considerable degree.

"It is noteworthy, however, regarding such opinions that even in restricted localities advocates of widely different rations will be found and, taking the whole country through, there is scarcely a combination of feeds containing the proper amount of nutriment that is not advocated by some one as the best suited to the production of rich milk. Experiment station workers, as a rule, agree that no material difference in the fat contents of the milk can be produced with the common fodders available upon the farm, so long as sufficient nutriment is supplied to and consumed by the cow. There are, however, a few concentrated feeds, not in common use, which have, in some cases, given considerable gains in the per cent. of fat in the milk produced, but these same feeds have, in other cases, either produced no effect upon the milk or have resulted in the percentage of fat. Regarding such feeds, there is a difference of opinion, but no one would venture to predict what effect would be obtained by their use in any given case. Any material change in the character of food is usually marked by some change in the quality of milk, which, in some cases, is made richer and in others poorer, but these changes are not permanent, there being a tendency for the milk to return after a time to its normal composition.

"Tests made with large numbers of cows, and extended over long periods have, for this reason, shown scarcely any difference in composition of milk that could be attributed to kind of food. The quality of milk produced seems to be far more dependent upon the nervous condition of the animal than upon the kind of nutriment supplied, and it is not improbable that the slightest differences, almost always observed when food is changed, arise from nervous conditions induced by a fondness or a dislike of the new food. A dairyman must, therefore, look chiefly to selection of individual cows, or to breeding, and not trust to his skill as a feeder to determine the character of milk pro-

duced. No man has succeeded as yet in feeding Ayrshire or Holstein cows in such a way as to cause them to give Jersey milk.

"It must not be inferred from this that it is immaterial how dairy cows are fed, for, although it may not be possible to materially change the quality of milk in this way, it is often practical, by judicious feeding, to greatly increase the yield of milk, and this without necessarily increasing the cost of the rations. As a rule, a narrow nutritive ratio with succulent feed, is conducive to the greatest yield. In this way, good feeding, or even high feeding, almost always pays, if the cows are properly selected, for the largest daily yield of fat with any cow is usually coincident with her largest yield of milk. On the contrary, insufficient food immediately diminishes the flow of milk and, if a short ration is long continued, the composition is also changed. In such cases, the per cent. of fat is usually above the average, while the solids not fat, and especially the casein, is lower. The yield of cheese from such milks is much more affected than is the yield of butter."

We think that the results of numerous careful experiments at our Experiment Stations clearly prove that every cow has her normal or maximum capacity for secreting butter fat (cream), and that once up to this capacity no amount of food or change in food will increase the ratio of fat in the milk, but the increase in either the quality or quantity of the food will be followed by an increase in the total amount of milk given, which is, in the end, equivalent, especially to the butter dairyman, to an increase in the fat content.

At one of the New York Stations, the experiment of feeding animal fats to the cows did not, after the effects of the few first feeds had passed off, increase the amount of cream or fatty matter in the milk. The cow very soon settled back to her normal capacity, and remained there or fell a trifle below normal.

It has been claimed that the oftener the milk is drawn from the udder the richer the average product will be in cream or butter fat, but it is difficult to account for such a condition and its existence is doubted by many of our best authorities. In referring to this, Dr. Babcock writes thus:

"When cows are milked at regular periods the milk obtained after a short interval is usually richer in fat than that obtained after a long one. On this principle, cows milked three times a day, give more and richer milk than when milked only twice a day. If, however, the number of milkings are increased beyond this the absolute amount of fat is not increased and often the milk is made poorer."

It is a well known fact to all practical dairymen that the "after milk," or strippings, is much richer in cream than that which is first drawn. This is accounted for upon the theory that by standing in the udder and milk veins the milk becomes partially 'creamed,' and that it separates into its richer and poorer portions in a manner similar to that which takes place when it is set aside in a pan and remains undisturbed for some length of time.

The theory adopted by some dairymen, is that the morning's milk is under similar conditions, richer than that drawn in the evening, but there is a lack of any practical proof of this; and it is generally believed that the differences shown by published tests, which are sometimes one way and sometimes the other, are in reality due to the facts that the period showing the richest milk has been the shortest, or that the milk which proved the richest was the result, in reality, of closer milking.

It is admitted by all who have had experience that the way in which the cows are handled, and the manner in which the milking is done, at least to a limited extent, affects both the quality and quantity of the milk. In referring to this item, Dr. Babcock gives the following practical views:

"Whenever any departure from the usual method of milking is made there is, with most cows, a decrease in per cent. of fat in the milk. The more nervous and excitable a cow is, the more marked is the change. Some cows are so susceptible in this respect that a change of milker, or even a change in the rate of milking, is accompanied by a noticeable change in the quality of the milk. Radical changes, such as milking one teat at a time, or the use of milking tubes, will nearly always diminish the fat in milk and sometimes to a surprising extent. In some experiments made at this station, with milking tubes, the milk contained less than one-third of the average amount of fat, when the cow was milked by hand. When cows are chased by dogs or worried in any way that excites them at the time of milking, a marked effect is to be noted in the quality of the milk. The best results are obtained when uniform methods are pursued and the cows are treated in a kind and gentle manner."

In referring to the difference which is known to exist between the first and last milk of the same milking, Dr. Babcock thus explains the causes which operate to produce the effect:

"At any milking, the first milk drawn (the fore milk), contains much less fat than that at the end of the milking (strippings). This has been attributed to a partial creaming of the milk in the udder, to a change in the character of the secretion, and to a slower movement of the fat globules through the smaller channels of the udder.

"Undoubtedly, all of these factors have their effect, the result being that the last milk may contain 10 to 12 per cent. of fat and the first less than 1 per cent. It follows that richer, as well as more milk, is obtained when cows are milked clean. Failure to do this results in a permanent loss, as the fat left behind in one milking is not received in the next. Moreover, this practice tends to reduce permanently the yield of milk, and if persisted in, the cow soon becomes dry. In testing cows it is especially important that they be milked clean, and that the sample taken for analysis be a true representative of the whole amount obtained."

English law is much more strict in relation to the quality of milk than our own, and the distinguishing points between the pure and the adulterated milk are much more closely drawn. In a case at the West London Police Court, the charge had been made against a certain milkman that he was offering and selling adulterated milk, the only proof being the fact that the public analyst had found a sample of his milk to show that 10 per cent. of the cream had been abstracted. The report of the case gives the following particulars:

"Case adjourned that the defendant's cow might be milked in the presence of the inspector and the analyst's assistant. This was done, and the milk also submitted to the public analyst, who certified it to be deficient in fat in both cases (16 per cent. and 10 per cent.). The cows were fed on hay, mangold-wurzel and brewers' grains. Defendant admitted that he knew the milk was deficient in fat. Expert evidence was brought to show that, from the way the cows were fed, they could only be expected to yield very poor milk, and though the samples did not come direct from the cow they could not be regarded as of the nature, substance and quality of milk. The vendor, in this case, had so fed his cows as to get a maximum quantity of milk, regardless of quality."

Milk Standards.

At each succeeding session of our Legislature attempts have been made to establish a State standard for the solids and fat of milk. Both sides of the question are usually heard by the appropriate committees, and this practically ends the matter and leaves the whole question of the propriety of establishing standards unsettled.

The testimony is conflicting and numerous statements are made, all being more or less warped or colored by the particular views of the person by whom they are made. One side claims that no grade of cows in the country can reach a standard similar to that established for the city of Philadelphia, while the opposition claim that cows can be produced whose milk may be watered to reduce it to the required standard of solids and fat.

W. J. Byrnes, chief inspector of milk for the city of Philadelphia, in referring to the milk and milk standards of that city, writes as follows:

"It has been alleged by milk producers and others that these tests applied by the division of milk inspection are in excess of the yield of good average cows. In support of this it is asserted that "no breed of cattle will average 4 to 4.5 per cent. of butter fat except the Jerseys and Guernseys, etc. The daily experience of milk inspectors proves the reverse of this. The average Jersey herd milk, as demonstrated by numerous analyses, is 15.23 per centum of solids, and 5.76 per

centum of fat, and the average milk of 136 dairies of domestic cattle shipped to this city was 13.15 per cent. of total solids and 4.04 per cent. of fat."

Prof. R. A. Pearson, of the National Department of Agriculture, in referring to the composition of milk, writes as follows:

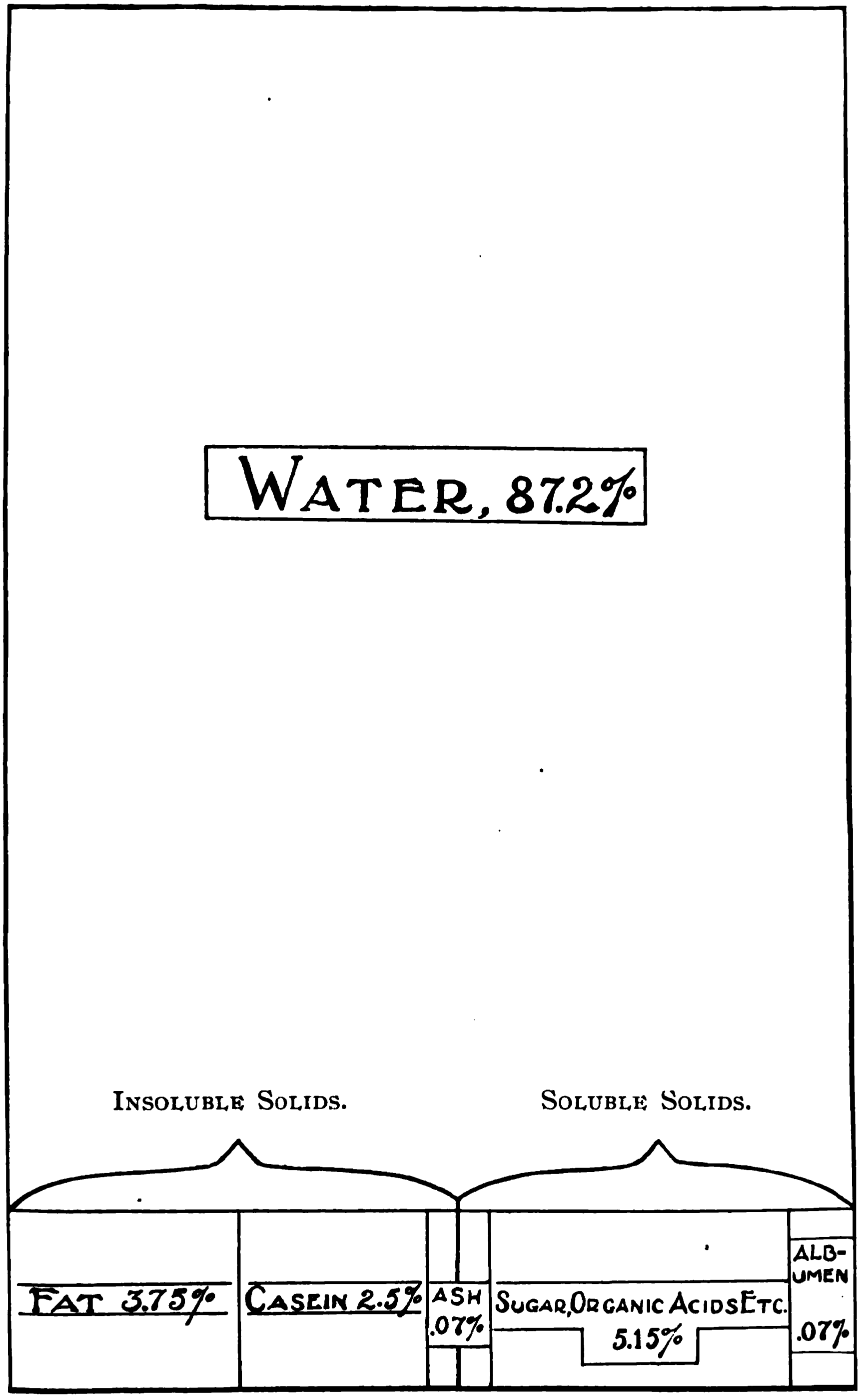
"One hundred pounds of good milk contains about the following amounts of the different constituents: 87 pounds of water, 4 pounds of fat, 5 pounds of milk sugar, 3.3 pounds of casein and albumen and .7 pounds of mineral matter, or salts.

"These constituents vary between wide limits; the total solids of milk may be as low as ten, or as high as eighteen parts in 100. This variation is due to several causes, some of which are given later. The fat varies in quality more than any other part of the milk, running as low as two parts in 100, and as high as seven; the larger the proportion of fat, the richer the milk. Most of the states and many cities have a legal standard for the composition of milk, and any falling below this standard is legally considered as adulterated, although it may be, in fact, the pure and natural product. The laws usually require 3 or 3½ per cent. of fat, and 9 or 9½ per cent. of solids not fat. The total solids required thus vary from 12 to 13 per cent., according to different laws, which, of course, means that in every 100 pounds of milk there shall be 12 to 13 pounds of solid matter. These legal requirements are justified by the fact that it is the solid matter and not the water which gives value to milk."

Prof. Voorhees, of the New Jersey Experiment Station, writes thus of milk standards:

"An investigation into the milk supply of large cities in the state, conducted by the Station in the winter of 1896, showed that the methods now in use in the retail business are unfair, both to the producer of rich milk and to the consumer. The chief reasons for this conclusion were: 1st, that the composition of milk, as delivered, varied widely, ranging from an average of 11.16 per cent. of total solids, and 2.84 per cent. of fat in the poorest samples, to 15.03 per cent. of total solids, and 5.67 per cent. of fat in the richest, a difference in the total solids of over 33 per cent., and in the fat of nearly 100 per cent. 2d, that in practically all cases, the milk was sold at the same price per quart.

"Under these conditions, the production of a poorer quality of milk. less than 3.5 per cent. fat, rather than higher quality, 4 per cent. of fat or over, is encouraged, then the consumers of the poorer product are charged higher prices for the actual nutrients furnished than are the consumers of the richer products. The investigation referred to. showed that the fat content of the milk was a safe guide as to nutritive value, hence, a practical remedy for this state of affairs would be to have retail transactions in milk made on the basis of its compo-



COMPOSITION OF MILK.

sition, or fat contents, rather than on the basis of volume, as at present conducted."

An article from the "Times and Register," written by George Abbott, of Philadelphia, gives the results of a large number of analyses of samples of milk drawn in the open market. From it we take the following results:

Dr. Bell, in "Analyses and Adulteration of Foods," pagès 20-26, English Government Labratory, states that in 235 analyses of milk of known purity of individual cows, 52 samples were below 12 per cent., the lowest analysis being 10.31 per cent., and the highest 17.2, the average being 12.83 per cent.

Dr. Bell gives the result of 24 samples of herd milk of known purity, in which three fell below 12 per cent.; the lowest result being 11.77 and the highest 14.69, the average being 13.22 per cent.

Dr. Veith, of the Aylsbury Dairy Company labratory, gives the average analysis of 1881 as 12.80 per cent., and also gives the following as the average results of the number of analyses stated:

	Solids.
1882, 12,430 samples,	13.03
1883, 15,005 samples,	12.97
1884, 14,235 samples,	12.96
1885, 16,037 samples,	13.06
1886, 17,269 samples,	12.92
1887, 17,269 samples,	12.92
1888, 18,611 samples,	12.94
1889, 18,354 samples,	12.94
1890, 20,674 samples,	12.83
1891, 19,849 samples,	12.76
1892, 23,865 samples,	12.76

Considering the above tables as a whole, we have a total of 193,598 samples of milk, which gave an average of 12.91 of total solids.

The same authority gives a large number of analyses made by Marshall & Cochran, of Philadelphia, from which we extract the following:

"Total number of analyses, 10,927; number below 12.5 per cent. of total solids, 3,352; below 12 per cent., 1,041; below 9 per cent. of solids not fat, 9,150; below 8.5 per cent. of solids not fat, 2,328. Of the 250 herds, the milk of 245 did not at all times keep up 12.5 per cent., and that of 210 herds did not keep up to 12 per cent. total solids."

Mr. Abbott also states that of about 50,000 analyses made by the Danish Dairy Supply Company, the solids not fat were found to vary from 8.70 to 8.80.

In the arguments before committees of the Legislature, considerable stress has been laid upon the statement that the milk of the same herd would vary materially during the different months of the year.

The New Jersey Experiment Station (Bulletin No. 123, page 9), gives the following as the results of the tests of their dairy herd during the different months of the same year:

May,	4.2
June,	4.3
July,	4.3
August,	4.4
September,	4.3
October,	4.4
November,	4.2
December,	4.2
January,	4.3
February,	4.1
March,	4.0
April,	4.1

In reviewing the results of this test, Prof. Voorhees, writes:

"It will be observed that although a wide variation exists in the fat content of the milk of individual cows, ranging from 2.6 per cent. to 8.3 per cent., in the month of December, the composition of the entire daily product is remarkably uniform; 4 per cent. of fat could have been safely guaranteed throughout the year. The lowest, 4 per cent., is found in the month of March, 1897, and the highest, 4.4 per cent., in August and October, 1896, or a range of 0.4 per cent. between the highest and lowest, a difference so slight from month to month as not to materially affect either the producer or consumer. In other words, it appears from a study of this herd, which is fairly representative of good herds throughout the state, that so far as uniformity in composition of the daily mixed milk is concerned, its sale on the fat basis would have been entirely practicable."

In the arguments before the committees, it has also been stated that the use of roots of any kind would very materially lower the composition of the milk, both as to solids and fat. An experiment made by the New Jersey Experiment Station, for the express purpose of testing this point does not bear out the statement. The results were as follows:

Full feed,	4.29
Full feed and potatoes,	4.23
Full feed,	4.20
Full feed and beets,	4.21

Upon the question of milk standards, we may quote the following authorities:

Prof. Barrister writes: "Too high and rigid standards have been fixed by some analysts, and no sufficient allowance has been made for some natural variations in milk. Ten per cent. of milk solids may be more difficult to obtain under some conditions than 12 or 14 per cent. under more favorable conditions. Allowance should be made for these actual variations, which some purely scientific chemists seem to have overlooked."

Prof. S. M. Babcock, after collecting the analyses of a large number of samples of fairly average milk, gives the following as its average composition:

Fat,	3.75
Casein,	2.50
Albumen and other proteids,	0.70
Sugar and organic acids,	5.15
Ash,	0.70
Water,	87.20
	100.00

This, in other words, is a standard of 12.80 per cent. of total solids and 3.75 of fat.

George Abbott, of Philadelphia, in referring to milk standards, writes thus: "This attempt to force an increased amount of solids is a sanitary blunder. As before stated, 'under feeding' is now almost unknown; 'intensive feeding,' being the order of the day.

"The milk of a cow reasonably fed, is evidently more wholesome than that of one thrown into a feverish and congested condition by large rations of highly concentrated foods. Likewise the milk of the first five months of the cow's milking period, though low in solids, is a more wholesome food than that of the remainder of the milking term."

The Society of Public Analysts has established, after the analyses of a large number of samples and numerous meetings for consultation, the following as the minimum composition of milk, and have agreed to consider anything lower as adulterated:

Total solids,	11.5
Fat,	3.0
Solids not fat,	8.5

After the analyses of many thousands of samples of milk, Dr. Vieth gives the following as a composition that should represent fairly the average sample of unadulterated and unskimmed milk:

Total solids,	12.9
Fat,	4.1
Solids not fat,	8.8

In one of the largest dairy companies of England, after careful analyses of more than 140,000 samples of milk, the following was agreed upon as a fair average sample:

Total solids,	12.69
Fat,	3.91
Solids not fat,	8.78

In an extensive test, in which the milk of individual cows, as well as the mixed milk of dairies was tested, the results were found to be as follows:

Total solids,	12.87	12.96
Fat,	3.98	4.00
Solids not fat,	8.89	8.96

In referring to the variation in milk from month to month, Dr. Vieth writes thus:

"The yearly average is the lowest I have observed since 1880, and so is the monthly average for June. In June, there was an analysis of 1,052 samples. Among all these, there was not a single one with solids not fat, below the Societies' (Public Analysts) limit, the lowest figure being 8.70. On one sample, the total solids fell below 11.5 to 11.38. As to the fat, the results were less favorable. In 51 samples, the calculated figures were below 3 per cent., the lowest being 2.6."

The monthly averages to which Dr. Veith alludes were as follows:

Total solids, from	12.4 to 13.6
Fat, from	3.6 to 4.6
Solids not fat, from,	8.6 to 9.1

Bacteria in Milk.

Bulletin No. 45, of the Arkansas Experiment Station, thus alludes to the introduction of bacteria of various kinds into milk:

"Infection during milking is generally the most obvious of all sources. It is manifested by the particles of hair, dirt, excrement, straw dust and other forms of uncleanness which drops into the milk pail. Some of this filth is recovered on the strainer, but a large part is not, being quite broken into minute fragments or dissolved in the milk. The particles of dirt which often form the greater part of this infection 'really composed largely of intestinal discharges,' swarm with bacteria, hence, infection from this source may be the largest of all. There is also, here, the greatest variety of species, giving rise to the most varied forms of decomposition in milk. The probable influence

of intestinal germs in producing harmful products in the milk has already been alluded to, but the common type of rapid souring and curdling germs have not been found.

"These, however, seem to be at least occasional inhabitants of the skin, and obtain entrance to the milk with the loose hairs dropping from the udder and flanks.

"It is evident that the amount of bacterial infection from this source will depend chiefly upon the milkman's appreciation of the value of cleanliness in milking. With care, it may be comparatively insignificant, while, on the other hand, with slovenly and careless methods, it may be enormous. Its effects in the latter case become manifest in the rapid spoiling of the milk, its unwholesomeness from an hygienic standpoint, and in the quality of butter and cheese prepared from such milk.

"Infection after milking includes all bacterial seeding which the milk receives from buckets, strainers, cans and other vessels used in storing the milk, either at the farm or dairy, in milk depots or in the household. It also includes germs deposited from the atmosphere, chiefly from the dust-laden air of the room. Compared with the amount of infection from unclean vessels, air infection is unimportant. Milk standing in an open bucket may receive from the air a few thousand germs in an hour, but every drop of milk remaining in that bucket from the previous milking will contribute, in summer weather, a seeding of over twenty million germs. The bacteria derived from unclean vessels are usually those more especially concerned in milk souring. They represent the species especially adapted for growth in this medium, and those which most rapidly produce the ordinary form of milk curdling. Hence, in referring to the keeping quality of the milk, this appears to be, ordinarily, the most important source of infection. This is so on account of the difficulty, often little appreciated, of sufficiently cleansing the buckets, cans, bottles, etc., used for the reception of milk. Ordinary or apparent cleanliness in this case is not sufficient to insure even reasonable freedom from the germs of the old milk, unless it has been obtained or supplemented by the aid of heat. The heat necessary for the destruction of these milk souring germs is not great. A momentary exposure to the temperature of boiling water, or longer exposures to lower temperatures, will, in general, insure their destruction, but neither of these conditions are fulfilled by the common practice of merely rinsing with a small quantity of hot water."

Transportation of Milk.

Prof. R. A. Pearson, of the National Department of Agriculture, furnishes the following information in relation to transportation of

the milk supply of our larger cities, and also in relation to the effect of transportation upon milk:

"Necessarily, the milk served in large cities is older than that served in towns and villages, as it has come from greater distances, and, for this reason, special care is required in warm weather to prevent souring. The milk is made as cool as possible on the farm and usually held in cold springwater until time to be delivered at the railroad station. If the distance to market is great, a liberal supply of ice is kept in the cars, and some railroads use refrigerator cars. When the milk is not delivered as soon as received in the city, it is stored on ice and is very soon sold when placed in the delivery wagons the next morning. In some cases the morning's and previous evening's milk are sent into the city on trains some time during the day. If the distance is not too great and the arrival in the city early enough, the night milk is often served as soon as received and the morning milk kept for early delivery the following day. In these cases, the city milkman serves milk from twelve to twenty-four hours old, but generally it is older.

"Railroads entering some of the large cities carry milk from points two or three hundred miles distant. Their trains usually arrive in the city about midnight, and bring milk of the morning and previous evening. It is delivered the following day, being twenty-four or thirty-six hours old when it reaches the consumer. A large part of the supply of New York and some of other cities is the so-called 'railroad milk.'

"The daily receipts in New York city are over 700,000 quarts (including some used in nearby cities), and practically all of this is brought by trains. Philadelphia uses about 300,000 quarts of milk per day, and, being situated in a good dairy country, a considerable part is delivered by wagons directly from the producing farms. Milk carried long distances in refrigerator cars should arrive in the city in as good condition as that which is carried but a short distance. It may seem to some that milk twenty-four or thirty-six hours old is unfit for use, but if it has been carefully handled from the first, it is much better than a supply not so old and not so well cared for. Clean milk, that has been cooled as soon as drawn and kept at a low temperature, will change less in two, or even three, days, and is, therefore, better, than new milk which has been carelessly handled. Thus, it is possible for old milk to be fresher in the usual sense of that term, than new milk."

Abortion and Milk Fever.

Bulletin No. 55, of the National Department of Agriculture, gives the following practical advice for treatment in cases of abortion and milk fever:

"In herds the best regulated and cared for, there will occasionally

occur a physical accident or some sudden fright which causes a cow to prematurely drop her calf. The herds should be constantly watched for symptoms of abortion, which will generally be recognized by the experienced herdsman. Should such symptoms appear, the suspect should be immediately removed to hospital until the case is over. or the signs disappear. In case abortion occurs in stable, yard or pasture, despite precautions, and wholly without warning, as is sometimes the case, take the animal to hospital at once and use every exertion to thoroughly cleanse and disinfect the place where the accident occurred. The aborted cow should be carefully nursed and the genital organs freely dressed with antiseptic solutions. The animal should not return to the herd until fully cured, clean and free from all vaginal discharges. Be on guard for a second case following the first in a few days or within three weeks; if a month elapses, recurrence is not to be expected. Veterinarians recognize two distinct kinds of abortion, viz, the sporadic, which is first mentioned above as resulting from accident, physical injury or fright, from disease of the uterus or from sympathetic influences, and the epizootic, or contagious, which is undoubtedly a germ disease, communicated from animal to animal by the germ and caused only by contagion. There is still much uncertainty about this dread disease and its prevention.

"Milk fever, 'dropping,' or parturient appoplexy, is another scourge of the dairy, twin to abortion. It is an affection which comes without warning, attacks the deepest and richest milkers, is sudden in attack, rapid in progress and generally fatal. The symptoms are a chill, twitching of the head muscles, failure to eat, chew the cud or pass manure, distended udder, without milk, insensibility of the hind quarters when pinched or picked. Later, the cow becomes unsteady on her hind legs and presently drops. Good cows should be carefully watched for forty-eight hours after calving, and if such warnings appear a veterinarian cannot be called too soon. Preventative measures form the best assurance of the owner against losses from this cause. The cow should have abundant exercise up to the week before calving, and then quiet and good care, with daily grooming and active rubbing. Keep the bowels active with proper food, or purgatives, if necessary. Insure comfort, guard against cold and endeavor to maintain an active circulation on the surface of the body. A strong dose of physic and brisk grooming may be used immediately after calving in case the cow is believed to be predisposed to milk fever."

SUPPLEMENTAL PAPERS OF THE VETERINARY DIVISION.

ABORTION—MISCARRIAGE—SLINKING—SLIPPING THE CALF.

By DR. LEONARD PEARSON, *State Veterinarian, Harrisburg, Pa.*

All of these terms are applied to the birth of calves before full term. Strictly speaking, abortion means expulsion of the foetus at such an early age that it is impossible for it to maintain its existence; while if the calf is born before it has reached full term, but is still able to live outside of the mother, the act is known as premature birth. However, the terms are usually employed indiscriminately and the differences just pointed out are of degree only.

There are numerous causes for abortion, one of the most common being a certain contagion which is transmitted from one animal to another. This produces the form which is known as contagious or epizootic abortion, and is the most dangerous variety, because it spreads from animal to animal, sometimes involving a large proportion of the herd, and frequently persisting from year to year. Moreover, it is transmissible to other herds through the interchange of animals and the use of a common bull, so that an aborting herd is a source of danger in the community.

Since it has been discovered that abortion is sometimes a contagious disease, there has perhaps been too great a tendency to ascribe all cases of abortion to contagion and to minimize unduly the importance of other more simple causes. Even when a large number of cows in a herd abort, this is not conclusive evidence that contagious abortion exists, because being subjected to the same conditions and influences, if these are faulty and sufficient to produce abortion in one case they can quite as well produce abortion in a large number of susceptible cows.

Among the most common causes of non-contagious abortion, or of premature birth, are different forms of violence. Unruly, vicious cows frequently cause abortion by hooking or by causing heavily pregnant cows to collide violently with fixed objects, such as door frames, gate

posts, etc., or to slip and fall while hastening to escape from their pugnacious associates. Being chased by dogs may also cause abortion. Slippery floors are fruitful sources of this accident, as are stable floors too steeply inclined towards the trench. Vicious attendants may cause abortion by kicking cows or attacking them with the milking stool. Abortion may also be occasioned by other diseases, as indigestion, accompanied by bloating, or disease accompanied by high fever. Some of the infectious diseases, such as foot and mouth diseases, contagious pleuro-pneumonia and even tuberculosis may cause too early expulsion of the uterine tenant. Certain forms of vegetation, especially the common fungus known as ergot, which grows upon a number of plants, but best upon rye, will excite contractions of the womb and lead to abortion. Weakness, from any cause, especially mal-nutrition, may produce abortion.

Abortion is supposed to be due in many cases to a sympathetic disturbance arising from contact with the odors of carrion or of the envelopes of aborted calves from other cows. Although this belief is quite general there is but little evidence to show that such is actually the case, and the probabilities are that many instances that are cited as examples of sympathetic abortion are actually of the contagious variety, because discharges of a cow suffering from contagious abortion will undoubtedly produce abortion in other cattle.

The means of preventing non-contagious abortion are as evident as the causes. Dairy cows cannot be handled with too much gentleness or care.

As for contagious abortion, it has been known for a long time that the disease behaves in such a way that it can only be explained by the germ theory, and the most successful treatment has been based upon the assumption that the disease has a microbian cause. Until quite recently, however, the complete proof of this theory has been wanting, but now thanks to the researches of a number of investigators, especially Prof. Bang, much light has been thrown upon this hitherto obscure subject, and a germ has been found in the fluids surrounding the foeti of aborting cows which has been grown in pure cultures and has produced abortion when introduced in small quantities in the genital passages of healthy pregnant animals. This work is so very interesting and important that a complete translation of Prof. Bang's paper is printed elsewhere. As stated in the paper referred to, the key note in prevention and eradication lies in isolation and disinfection. Briefly summarized, the suppression of abortion in an infected herd depends upon:

The removal from the herd of cows that have aborted, or are about to abort.

The thorough disinfection of their surroundings.

The destruction of the foeti and membranes by burning or deep burial.

Disinfection of the genital passages of the cow by means of daily injections of a weak solution of carbolic acid or creolin.

This treatment must be continued until all signs of discharge have disappeared. Moreover, such cows must not be bred until recovery is complete.

The preputial cavity of the bull must be washed out by injections of a solution of boracic acid, 20 grains to the ounce, or bichloride of mercury 1 to 3000 of water after each service.

There are still numerous subjects for investigation in connection with this disease. It has been noted, for instance, that cows that have aborted several times develop a certain immunity to the action of this specific organism, whereby they are enabled to carry their calves to full term, although the bacillus is still probably present. If possible, it is important to develop a method of immunising the animal so that the same result can be produced quickly by artificial methods. Moreover, the resistance of this germ to various conditions and the disinfectants should also be ascertained so that more perfect methods of treatment, prevention and disinfection may be developed. We should know, also, how long this germ will live outside of the animal body, and whether there are other organisms that may also produce this disease.

The first great step in the prevention of contagious abortion seems to have been achieved in the discovery of the cause. It remains now to develop better methods for destroying this germ or rendering it harmless. This is a great field for useful work and part of the facilities of the Bacteriological Department of the State Live Stock Sanitary Board are already engaged in this direction.

TUBERCULOSIS OF CATTLE.

By PROF. B. BANG, *Copenhagen, Denmark.*

I have been asked to write for publication in Pennsylvania, a paper discussing some points concerning tuberculosis of cattle on which, I am told, it is useful to enlighten the live stock owners of that State. It was thought that the experience I have gained from my long occupation with these questions, might perhaps contribute to a closer understanding of tuberculosis of cattle, and of the means to combat it.

In trying to fulfil this wish, I think it best to keep close to the following subjects:

1. As to the desirability of having herds freed from tuberculosis.
2. As to the transmission of tuberculosis between cattle stabled and herded together.
3. As to the value of good sanitary conditions, light, cleanliness, ventilation, etc.
4. As to the effect of tuberculin on healthy cattle.
5. As to the propagation of tuberculosis among swine, calves, other animals and people through the milk.
6. As to the accuracy of the tuberculin test.
7. As to the success of the work directed against tuberculosis of cattle in Denmark, and the favorable manner in which these operations are accepted by the owners of live stock.
8. As to the advantages which will accrue from the suppression of tuberculosis among cattle.

1. AS TO THE DESIRABILITY OF HAVING HERDS FREED FROM TUBERCULOSIS.

At first this question may seem a superfluous one, but on further reflection its importance is plain. It is clear that the stock owner who loses one or several cows from consumption, or sees the animals emaciate instead of fattening, needs no explanation as to the desirability of being freed from a scourge which causes such evident losses. But the fact is, that tuberculosis can exist, can even have gained a considerable extension in a herd and yet for a long time the owner may have very little notion of this calamity. Tuberculosis—unlike anthrax, which causes every individual attacked to be violently diseased and usually causes death in the course of a few days—is a very insidious illness that begins quite imperceptibly and will often for a long time keep completely hidden. This latent character of the illness is indeed no exception, it is on the contrary the rule. By tuberculin tests you will sometimes see three-fourths or almost all the animals of a herd reacting, thus revealing themselves to be infected with tuberculosis, though they are looking quite sound. I even know cases, where the owner of such stock maintains never to have perceived the least traces of the disease. Now such a man might doubt whether it be worth while to make sacrifices to get rid of a disease which apparently does so little harm. Of course such cases are rare where no disease at all has been detected in infected herds; usually some cow or other will be unthrifty or thin, but most farmers are accustomed to have misfortune occasionally, and if this does not happen too often it will not annoy them seriously.

It is this insidious progress which explains why tuberculosis has in most countries attained such an enormous extension. It does not excite immediate attention. In all countries in which it has been possible to follow the history of the disease, and to ascertain with some ac

curacy the date and ways of its introduction, as for instance Denmark, Sweden and Finland, you will find that at first it has not caused great trouble, and that years have passed before much has been spoken of it, and the same thing happens in every herd into which it is nowadays introduced. But gradually the losses sum up, and it develops into a positive scourge. And in many infected herds the losses will occasionsionally be very great. Sometimes it is not easy to see what has made the disease progress rapidly in so many infected animals, sometimes the cause may easily be found. Thus an acute contagious disease will sometimes be followed by a rapid development of tuberculosis in infected cattle. I know a large farm with about 200 head of cattle in Denmark, where tuberculosis was known, but had never appeared to be of a malign character; in 1893 the herd was infected with foot and mouth disease, and after this the tuberculosis made such progress that in the course of the following years the owner had to slaughter about 50 head of cattle, part of which were in a very reduced state.

Thus it will be evident to the intelligent farmer that he must at some time free his herd from a disease continually menacing him with great losses. If he has not himself suffered from the scourge of tuberculosis, he will know neighbors who have suffered severely from it, and he must consider that the same fate may be his. Another circumstance of more recent date will arouse his attention. Since it has been ascertained that consumption in man depends on the same cause as tuberculosis in cattle, a fear has arisen in all countries that this disease so fatal to man, which in most countries causes one-seventh, in some places even one-fourth of all deaths, may have one of its sources in animal tuberculosis. Nor is this fear without foundation, although it is often exaggerated. Even if the farmer does not care to subdue tuberculosis on account of the losses caused by the sickness and death of his cows, he will be obliged to take an interest in this matter on perceiving the difficulty of selling the milk or the meat derived from cattle more or less tuberculous.

2. AS TO THE TRANSMISSION OF TUBERCULOSIS BETWEEN CATTLE STABLED AND HERDED TOGETHER.

It is quite impossible for an animal to get tuberculosis without the tubercle bacillus being admitted into its body. These are pure parasites which do not develop outside of the animal body. From a tuberculous animal they can be excreted in different ways—by expectoration, with the manure and urine, with the milk, with discharge from the genital organs, etc.; and when they have left the body which has housed them, they can keep alive for rather a long time, though rarely more than half a year, and infect another animal or man by being admitted to his body. It is only under special laboratory conditions that the tubercle bacillus can be brought to propagate itself outside of the body, and thus we are sure to be right in maintaining that all the

tubercle bacilli which we encounter on our way must have been excreted by a sick animal or a sick man. They are, therefore, not found everywhere, but only where tuberculous animals or men are living or have lived recently. Hence, the danger of becoming infected with them is far greater in closed places (rooms or stables) than in open fields, where the germs are diffused so that only a few occur in a given place, and where they will, comparatively, soon be destroyed by natural influences, especially the sunlight. The smaller, darker and closer the room is, the greater the probability that sound individuals will be infected. That it must be so we may know beforehand and that it is so experience teaches us, as regards both men and animals. That tubercle bacilli are not found everywhere is clearly shown from the fact that in countries where tuberculosis is common, many herds will be found completely exempt. This is proven not only by the fact that the owner has never perceived any trace of it, but the tuberculin test shows that not a single animal reacts. I ascertained some years ago in Denmark that more than one-fifth of the examined herds prove to be quite free from tuberculosis, and afterwards the same thing was observed in many other countries, as, for instance, in Pennsylvania. And in Denmark, at least, many of these herds are comparatively large, embracing 40 to 50 individuals. These are almost always herds which have been bred and reared on the farm and to which, for many years, no new animals have been introduced. I have shown that some of these herds were made up of cows in which the milk yield is developed to the highest degree, so that according to old views, the animals must be supposed to be highly predisposed to tuberculosis, but no contagion had been introduced, and accordingly there was no disease.

Thus it is contagion on which everything depends and contagion occurs chiefly by association in the stable with tuberculous animals excreting tubercle bacilli. Of course there other ways by which it may be transmitted and of these feeding with tuberculous food, especially with infected milk, is the chief one. Also, copulation may sometimes transmit contagion when tuberculous affection combined with discharge are found in the genital organs. Tuberculosis may also be transmitted from the mother to the foetus through the placenta (perhaps also from the male animal to the egg), but congenital tuberculosis is comparatively rare.

Yet this form of contagion is not quite so rare in cattle as many, for instance Nocard, consider it to be. I have especially directed my attention to this question, and in the course of eight years, mostly by the help of several veterinary surgeons at slaughter houses, have been able to gather not less than 85 cases of congenital tuberculosis, partly in foeti, partly, and these cases were the most common, in new-born

calves.* But the tubercle bacilli can only be transmitted from the mother to the foetus through the blood—if the uterus of the mother be not affected by tuberculosis—and, therefore, foetal tuberculosis is only found in calves whose mothers are highly tuberculous, as only such individuals have tubercle bacilli in their blood. Cows that have only local tuberculosis (for instance of lungs, bronchial or mesenteric glands) cannot contaminate their foeti. Thus the great majority of tuberculous animals will bear sound calves. It is precisely on this fact that I have founded my system of combating tuberculosis—which purposes to raise calves born by sound looking cows, even if the tuberculin test has proved these to be already infected with the disease, but to remove the calves from the mother's stable as soon as born, place them in a locality free from contagion and give them boiled milk or milk from absolutely sound animals.

On the basis of my experience I believe I may say, that congenital tuberculosis will not even be found in one-half per cent. of the calves in a tuberculous herd.

Contagion through infected milk plays a very large part, and according to my experience is the essential cause of tuberculosis in young calves, but this cause will only work the first year at most. After that time the calves, at least in Denmark, get no milk. And as tuberculosis is a disease the frequency of which increases largely with age, it is clear that we cannot accuse milk of being its chief cause. It is evident that year by year the cattle pick up contagion with more and more frequency, and the chief source must be the tubercle bacilli disseminated in the stable by other tuberculous cattle. In itself it is of no great consequence whether we suppose the tubercle bacilli to be chiefly admitted through the digestive organs or the respiratory organs. Both ways are possible. The food and the water may be infected by expectoration and discharge from the nose or by bacilli attached to particles of dust or the cow may lick objects (walls, cribs) which are contaminated with evacuations containing bacilli, or inhale tubercle bacilli attached to particles of dust. As showing the first method of transmission it is often noticed that a newly bought sound cow will strikingly often become affected with the disease when it is put in a place occupied shortly before by a badly tuberculous cow (if the place has not been thoroughly disinfected), and also that the disease very often passes to the nearest neighbor of a sick beast. But contagion through the air, no doubt, also plays an important part. The great frequency with which tuberculosis is found only in the lungs and the bronchial glands, speaks strongly for contagion through inhalation. My experience also points strongly in the same direction, for

*These tuberculous deposits are as a rule very small and calcified. They are to be found in the liver and, especially, in the portal glands. Generally you will also find some deposits in the mediastinal and bronchial glands, sometimes also in the lungs, the spleen and other organs.

many and many a time I have observed that transmission is not avoided by placing the sound animals in one end or on one side of the stable, while the tuberculous cattle are placed at some distance from them and are without any direct communication with them. If you will avoid the dangers accompanying association in the stable, the sound animals must be entirely removed from the diseased ones and placed by themselves.

In pastures the danger of contagion will be far less than in the stable, especially when the cattle are tethered, as is the case in Denmark. When the cows are not tethered they may of course communicate the infection by licking each other or by drinking from the same receptacle. I know some places where tuberculosis seems to have been caught on the pasture; so when sound and reacting animals are on the same farm they ought to be kept in different fields.

3. AS TO THE VALUE OF GOOD SANITARY CONDITIONS, LIGHT, CLEANLINESS, VENTILATION, ETC.

On this point I can be brief, referring to what Dr. Leonard Pearson has written in the second annual report of the Pennsylvania Department of Agriculture.

The importance of cleanliness in the stable is easily to be understood. If animals excreting tubercle bacilli with the faeces or with discharges from nose, mouth, vagina, etc., are found in the stable, it is clear that the danger of contagion is very much diminished, when these things are quickly removed and are not allowed time to dry into dust. The better the ventilation, the less the number of germs floating in the air and the less probability of their infecting a sound animal. It has also been proved that the danger of development of disease is greater when many bacilli than when few are admitted to the organism. The light of the sun is the most efficient natural means of disinfection, and a light stable will more easily be kept clean, for the dirt will be noticed.

But fresh air, light and good food, i. e., good sanitary conditions, are also of the greatest importance in giving animals as well as man resisting powers against the germs of disease admitted to the body. They cannot exactly prevent the animal from being infected, but the better the sanitary conditions are, the greater the probability that the animal will be able to confine the tuberculosis to the first organs infected or their lymphatic glands, where the bacilli have entered, arriving thus at the result, which is luckily not uncommon, that for a long time—perhaps for many years—the tuberculosis will remain an insignificant affection, which does not prevent the cow from giving sound milk, sound meat and sound calves.

4. AS TO THE EFFECT OF TUBERCULIN IN HEALTHY CATTLE.

Tuberculin is a preparation which cannot contain living bacilli. To

be sure it is made of beef tea in which the bacilli have been grown, but the culture has been subjected to prolonged heating at 115 degrees C., which absolutely kills the bacilli and, next, the dead bacilli are removed by filtration. Thus it is evident that the injection of tuberculin cannot call forth the disease in sound cattle. A fear has been expressed that tuberculin might give rise to an acute blazing up of tuberculosis in tuberculous animals, thus causing animals which had before appeared comparatively sound to become seriously affected by the development of an acute miliary tuberculosis, as was at one time supposed to be of frequent occurrence in human tuberculosis. But I can prove that as to cattle this at most, happens very seldom.

In Denmark we have several large herds in which 100 to 200 cattle—in one even 350—reacted two to four years ago. These reacting animals have been allowed to live, they have, however, been separated from the sound cattle, and it is evident that in these reacting sections the disease has not progressed at a more rapid rate since the test than before. Several owners even maintain that it has progressed less rapidly. Of course, in such a herd the disease will naturally reach an advanced development in some individuals, but this would have happened even if no tuberculin test had been made. Only a few farmers mention that they have the impression that the disease has made great progress in an occasional individual some time after the test; but such single observations may depend upon accidental coincidence, it is absolutely not the common rule. If it has happened frequently it would, of course, have awakened the attention of the farmers, and it is quite impossible that tuberculin could have been used in always greater measure year after year if the test had frequently been followed by aggravation of pre-existing disease.

5. AS TO THE PROPAGATION OF TUBERCULOSIS AMONG SWINE, CALVES, OTHER ANIMALS AND PEOPLE THROUGH THE USE OF MILK.

That the milk of tuberculous cows is liable to propagate tuberculosis to calves, swine and other animals, is an observation I have often made. Several years ago I reported that by the autopsy of 34 milk fed calves reacting by the test of two large herds, I found that in 24 of them the disease was evidently due to infection through the food. In these cases tubeculosis was only found in the lymphatic glands of the throat or mesentery, in the walls of the intestinal canal or, at least, in these places it was of oldest date. And since that time I have made numerous similar observations. In Denmark, the swine are almost always fed with skim milk, buttermilk and whey in addition to grain, and formerly it was often noticed that when these milk foods were given raw (unboiled or insufficiently pasteurised) the swine almost always suffered from tuberculosis, where this disease was very prevalent among the cows. The oldest centres of tuberculosis were here to be

found in the lymphatic glands in the neighborhood of the throat.* In Denmark, milk is often given to young horses or to sick horses, and in those parts of the country where this custom is frequent, tuberculosis is not rare in the horse. This animal, when infected with tuberculosis, always has tuberculosis of the digestive tract. A few ulcers are found in the small intestines and enormous tuberculous infiltration in the mesenteric glands, sometimes also in the lymphatic glands of the throat. The disease gradually spreads with the blood, but it is easy tc see, especially in the lungs, that these other formations are secondary. To cats and dogs the disease is also sometimes transmitted through the milk; nor can there be any doubt, that by this means it is not infrequently transmitted to man, especially to little children.

In Denmark we have a peculiar system which throws a clear light upon the importance of milk as a source of contagion. From almost all smaller farms the milk is daily sent to common creameries where butter is made. Cheese is sometimes made of the skim milk, but the greater part of it is sent back to the farm, where it is used as food for calves and swine. Of course the various farms do not get back their own milk, but part of the mixed supply. Now, if among the farms furnishing milk for the creamery some are found whose cows are greatly tuberculous, tubercle bacilli may be brought with the skimmed milk to a sound herd and formerly this happened frequently. By tuberculin tests it has in some cases been found that all the adult cattle were sound, while some calves reacted, quite the reverse of the usual case, which is that the disease prevails to a greater extent in old animals than in young ones. This is undoubtedly the consequence of contagion through the milk. In many cases, indeed, it has been shown that the disease is only found in animals that have consumed milk at a time when the apparatus for pasteurising did not work properly. Nowadays, as a rule, the danger in question is avoided by the skim milk being heated to a high decree before leaving the dairy.

Is then all milk of tuberculous cows virulent? By no means. Luckily this is only an exception, but no rare one. The greatest danger, as is well known, is attached to the milk from a tuberculous udder, and this ailment is a very dangerous source of tuberculosis for man, because at the beginning of the disease the tuberculous udder—often even almost a month after the appearance of a hard tumor—secretes milk of almost natural appearance, which people will often be tempted to use. But, also, when no tuberculous deposits can be pointed out in the udder, the milk may contain tubercle bacilli if the cow suffers from advanced generalized tuberculosis, so that tubercle bacilli now and then circulate in the blood. I have previously reported experiments I made by inoculating rabbits and guinea-pigs with milk from 63

*Since attention has been directed to this danger, tuberculosis in swine has greatly diminished in my country.

highly tuberculous cows with apparently sound udders, which showed that nine of these animals secreted virulent milk. As long as the cow has only a limited tuberculosis—as is luckily the case with the enormous majority of reacting animals—it will not secrete tubercle bacilli with the milk. But in a large herd of tuberculous cows it will probably almost always be found that some one secretes virulent milk on account of having either tuberculosis in the udder or generalized tuberculosis.

The danger of contagion through the milk can always be avoided by boiling it or by heating it 185 degrees F. Even the influence of a somewhat lower temperature—167 degrees F. to 176 degrees F.—will diminish the danger very much, as I have found that so far as rabbits are concerned, milk heated to these degrees could infect by injection into the abdominal cavity, but not by feeding. We therefore in Denmark always recommend either boiling or heating to 185 degrees F., if the milk is to be given to calves, and we are not sure that it is derived from entirely sound cows. Experience shows that the more carefully this heating is performed, the greater security against the propagation of tuberculosis to these animals and to horses, swine, etc. Each year this is performed in a better manner. At present a bill is before our parliament to prohibit all creameries from returning skim milk and buttermilk that has not been heated to 185 degrees F. It is also proposed that cows with tuberculosis of the udder are to be killed and the owner receive compensation from the State.

Little children usually get boiled milk in Denmark and in Copenhagen and in several other towns are concerns selling milk that has been heated to exactly 185 degrees F. When such milk is immediately cooled by ice, it does not get the cooked taste, to which many people are so averse.

Like skim milk, buttermilk and whey, the butter too may contain tubercle bacilli. Luckily this happens less frequently at least when, as in Denmark, it is made of cream which has been separated from the milk by centrifugation, as most tubercle bacilli are thereby thrown out of the milk.* Excellent butter can be made of cream heated to 185 degrees F. or even to a higher point.

6. AS TO THE ACCURACY OF THE TUBERCULIN TEST.

The introduction of tuberculin marks a most remarkable advance in the diagnosis of tuberculosis, as it enables us to discover the presence of the disease in the earliest stages, and in very slightly developed forms. But it has three essential disadvantages. In the first place the violence of reaction has no constant relation to the development of the disease. Farmers often believe the cow reacting violently to be extremely tuberculous and the one reacting feebly to be compara-

*And every possibility of danger can easily be avoided by pasteurising the cream before churning as now-a-days is done almost everywhere in Denmark.

tively sound. The case is rather the reverse, but this is not constant either. Next, tuberculin is not absolutely to be relied upon. To be sure you will very seldom be mistaken in the conclusion that a cow, which has shown an evident reaction, is indeed tuberculous. I, for my part, know only three or four cases in which I could find no tuberculous deposits in such an animal, and in these cases the fault may be mine and not that of tuberculin, as it is impossible to examine every part of the body of a slaughtered animal. The tubercles may have been hidden in an unusual place, or they may have been so small or so fresh, that they could not be discovered. This case then is a very rare one, though the unskilled observer, for instance, the butcher, may believe to be a frequent one. Moreover, it must be considered that it would not be a disaster even if a sound animal should for once be considered tuberculous. Far more frequent is the case that an animal which has not reacted, is proved by slaughtering to suffer from tuberculosis. But usually this has not the practical importance one would suppose it to have, as in the great majority of cases the deposits in question are very small, very old or greatly calcified indicating that the process has become stationery. Experience teaches that such small deposits usually keep quite unchanged for a series of years, and may even at length be healed. In fact, animals which have this form of tuberculosis will be quite harmless to their associates as they do not excrete tubercle bacilli. But there are also cases in which an animal suffering from far advanced and very contagious tuberculosis does not react to tuberculin. This is a very provoking fact; luckily, however, it happens but seldom, and we must be taught by it not to rely on tuberculin alone, but to have recourse to clinical examination which will usually enable us to detect tuberculosis in such advanced forms. In the third case, tuberculin has the imperfection that reiterated reactions will not rarely call forth a temporary insusceptibility to the substance so that tuberculous animals will at length cease reacting to a new injection. This circumstance may occasion fraud in dealing in cattle, but as the fact is very inconstant the imposture will by no means always be successful.

Insusceptibility to tuberculin is most apt to follow the repetition of the test at short intervals, but it may also be seen when a whole year has elapsed between tests. In these latter cases according to my experience, the disease will almost always be insignificant. Nevertheless, when—as in Denmark—tuberculin is employed in order to divide a herd in two sections, one sound and one reacting, the latter should not be tested more than once, that uncertainty may not be created by the failure of the reaction in some animals upon renewed tests. Such animals ought to remain in the section to which they have originally been conveyed, for even if most of them are not dangerous at the time, you cannot be certain that the small latent tuberculosis may not blaze up.

But the imperfections of tuberculin mentioned here are eclipsed by its good qualities. According to my experience which is founded on a very great number of autopsies, it is in 10 per cent. of the cases at most that tuberculin will be at fault (the immunity after reiterated reactions not taken into consideration), and it is only in a very small percentage of these cases that the fault will be of consequence. Tuberculin, therefore, in spite of its imperfections, marks an immense advance in the diagnosis of tuberculosis. By its help we are able to discover a great number of cases of tuberculosis, which were formerly absolutely concealed. Until something still better has been found, we must consider it to be our best weapon in the struggle against tuberculosis of cattle.

7. AS TO THE SUCCESS OF THE WORK DIRECTED AGAINST TUBERCULOSIS OF CATTLE IN DENMARK AND THE FAVORABLE MANNER IN WHICH THESE OPERATIONS ARE ACCEPTED BY THE OWNERS OF LIVE STOCK.

That owners of live stock in Denmark have been very willing to make use of tuberculin is clearly proved by the great number of tested animals. In April, 1893, an act was passed placing 50,000 kroner per annum (about $12,000)* at the disposal of the Government in order to make it possible to distribute free tuberculin and pay the veterinary surgeons for making the tests (injection and measuring of temperature) on the herds of owners who promised to employ the remedy in a rational manner, that is, who promised to separate the animals not reacting from those reacting or not tested. Quite exact statistics as to the number of animals which were under this provision in each of the following years cannot be given, but on calculation from the quantity of tuberculin which has been sent out to the veterinary surgeons, there have been injected about:

	Young Cattle.	Adult Cattle.	Total.
In the fiscal year 1893-4 about,	4,800	450	5,250
1894-5 about,	11,000	6,800	17,800
1895-6 about,	32,200	33,000	65,200
1896-7 about,	49,000	44,000	93,000

Up to the summer of 1897, I had received reports of test of 158,911 animals in 5,733 herds, and since that time many injections have been made. Denmark has about the same number of cattle as Pennsylvania, about 1,700,000 cattle of all kinds, including about 1,000,000 milch cows. We can estimate that from 8 to 9 per cent. of the cattle have been tested in the last years. Now if it is asked whether all the stock owners who have had their cattle tested at the cost of the state have fulfilled the promises given as to the separation of sound from re-

*Since 1896 100,000 kroner.

acting animals, the answer must be: No, not all; but most of them have at least tried to do it as well as circumstances would allow. As the test is given freely, no matter whether evident traces of tuberculosis have been observed in the herd or not, many herds have been tested in which all animals were proved to be sound. This applies to 22 per cent. of the tested herds. In many others, only a few animals reacted, and it has often been easy to put such animals in a separate place till they could be sold. In those cases, in which almost all grown up animals reacted, while most of the young cattle were sound, it has often been possible to place the latter in a particular stable for young cattle, as such a one can easily be made if it is not previously at hand. The greatest difficulty of isolation occurs when there is both a great many diseased as well as sound adult cattle. In this case it has usually been necessary to divide the stable by a solid partition. But not unfrequently the construction of the stable has been such that it was necessary to have doors in the partition to allow feeding or removal of the manure. This arrangement is not a good one, as there is too much opportunity for contagion even if the doors are kept shut during the time when not in use. Though the result has often proved by the renewal of the test to be a good one, even under such circumstances, I know many cases in which such an imperfect separation has proved insufficient. But when the sound animals have been placed in stables which were indeed completely isolated, and especially in different buildings, the result has usually been very satisfactory. The best manner of isolation is, of course, to place the sound animals on another farm from that occupied by those which have reacted.

The method which according to my recommendation is used in Denmark to combat the tuberculosis of cattle is very moderate. It does not aim at exterminating the evil with one blow, but strives to reduce it gradually. It takes it for granted that animals reacting to tuberculin but showing no evident clinical signs of tuberculosis, are in the majority of cases affected but to a limited extent, and that therefore it is not necessary to kill them. They may live and keep apparently healthy for years, their milk, as a rule, does not contain tubercle bacilli and by pasteurization every danger of contagion can be avoided. Their flesh also will generally be safe food and by control of the butchering those carcasses whch might afford danger of contagion can be withdrawn. And in the immense majority of cases they will give sound calves. Thus, generally, there is no reason for killing a sound looking animal only because of its having reacted, it may continue to live and be used as before, and the herd may be maintained by self-breeding. But as among reacting animals there will always be some subjects in whom the disease develops so that it will become a bearer of contagion, the reacting animals must always be separated from the sound ones as thoroughly as possible. The newborn calves must im-

mediately be removed from the stable where the reacting cows are placed, and they must have boiled or pasteurized milk. The sound section ought to be tested with tuberculin at least once every year in order to enable us to remove the animals which may have got tuberculosis in spite of the separation.

As an instance of the result which may be attained by carrying through consistently the method just outlined, I shall name two farms where the separation has been brought about in a very simple manner by dividing the large common cow stable by a partition, by employing different sets of attendants for the two sections and by making the two sections use different pastures in the summer. The first of these farms is Thurebylille, where I first introduced the system in the year 1892, the second is a farm in Jutland, where we began in 1894. On the first of these farms, the common calf stable communicates with the sound section, on the second the calves and the young cattle are placed in different buildings on the same farm. In both places, tuberculosis was at first widespread, but not very malignant, as the number of animals which had to be slaughtered as obviously diseased was not large. It will be seen that in the course of these years a large sound herd has grown up by raising the calves, born partly of sound mothers, but in the first years, for the greater part, of reacting mothers. The reacting section, in the course of years, has been diminished by gradual removal so that at Thurebylille it has diminished from 131 to 48, on the other farm from 139 to 64, and in the course of a few years this section will quite disappear. On Thurebylille I have been able to closely follow these isolated animals and have myself re-examined almost all of them by slaughtering. In some of them, the disease has no doubt made progress and a few have been condemned by physical examination, but most of them were capable of being used for food and in

Thurebylille.	Reacting section.	Sound section.	Animals which reacted in the sound section.
April, 1892,	131	77	..
October,	..	77	7
May, 1893,	90	103	10
October,	..	107	1
April, 1894,	87	122	2
October,	..	119	1
May, 1895,	69	136	3
October,	..	132	2
May, 1896,	54	149	7
October,	..	147	7
May, 1897,	48	155	6
October,	..	157	2

Farm in Jutland.	Reacting section.	Sound section.	Animals which reacted in the sound section.
January, 1894,	139	86	..
December,	..	114	8
May, 1895,	..	117	1
October,	..	140	2
April, 1896,	..	148	14
October,	..	153	3
May, 1897,	..	184	5
November,	64	169	6

many of them tuberculosis has proved to be very insignificant and greatly calcified, conveying the impression of having remained quite stationary for several years. Of the animals sold from the farm in Jutland, I know that they have not often caused their proprietor any loss.

Nevertheless it will be seen that in spite of the separation every year several animals have fallen by renewed test of the sound division, some years very few, some years more. So by this separation we have not succeeded in absolutely excluding from the sound section every trace of contagion from the reacting one. But this cannot be expected when the two sections are so near each other; there are too many probabilities of transmitting contagion through various vehicles (people, dogs, cats, rats, etc.), perhaps also through food, as in Danish stables the common hayloft is usually above the stable. But the progress is considerable.

On a great many other farms where this work has been carried on for a longer or shorter time in the same manner, the result is quite similar. Where the division has been fairly good it is about the same as here, where less care has been taken or where there has been a door in the wall the result is, as a rule, not as good, but where it has been possible to place the two sections in quite different buildings or on separate farms it is usually much better.

All things considered, I believe it to be beyond doubt that the whole movement has been a very useful one.

A precise statistic statement which could prove how great the progress has been I am not able to give, partly because my time has been too occupied to allow me to exactly revise the great mass of material. Also in the greater majority of herds the tests have been made in the last year so that the results are not yet at hand. But different preliminary summings up clearly indicate a pronounced amelioration. The increasing demand for tuberculin tests at the expense of the state also indicates that the farmers are on the whole satisfied with the results which they see.

We are then progressing, but still we are far from the end, and though the mild method applied here had undoubtedly proved to be of good use, I will by no means maintain that more could not and ought not to be done. I have already mentioned that at present it is planned to require by law the heating of all skim milk and buttermilk in creameries, and the killing of all cows with tuberculosis of the udder. But I am also endeavoring to provide for the awarding of some sort of premium on a prompt extermination of cattle infected with tuberculosis of a contagious character as well as with tuberculosis of the udder that is, tuberculosis of the uterus, of the intestines and advanced tuberculosis of the lungs. The plan is to provide for a partial compensation to be given for such animals, for instance, one-fourth of the value of the flesh, if the flesh can be used, three-quarters if it is unfit for use. For the present, this compensation only to be given to such owners as combat tuberculosis by rational applications of tuberculin in their herds (after the method described). If it is possible, at present, to carry through such a motion is doubtful, but I consider the step to be absolutely in the right direction, as the chief point is to induce the proprietor to part with these animals that are the greatest sources of the continued spreading of the disease. Fortunately, the knowledge of this matter has already penetrated so far that the number of such animals has considerably decreased on Danish farms.

8. AS TO THE ADVANTAGES WHICH WILL ACCRUE FROM THE SUPPRESSION OF TUBERCULOSIS AMONG CATTLE.

On this point I can be very short. Though there cannot be laid stress enough on the fact that tuberculosis in cattle is often a very innocent disease which does not menace the life of the animal or diminish the worth of its products, and that there is no cause to be too much frightened by the results given in almost all countries by the application of tuberculin on a large scale, that shows the disease to have spread far wider than any one would formerly have believed; yet on the other hand, it is quite evident that *tuberculosis is one of those scourges which cause the greatest harm to the farmer.* The number of animals that perish by it or have to be slaughtered in bad condition is so great that a regard for his own economic interest should alone suffice to strongly interest the farmer in rooting out this scourge. The growing claims which in view of the hygiene of man are almost everywhere put to the soundness of meat, milk and milk produce, render this still more necessary for him. No doubt these claims may be sometimes exaggerated, especially regarding the meat, but the movement exists and the farmer, like every other manufacturer must have an open ear to the claims of the times. And the augmented confidence in the soundness of its animal products which must follow earnest efforts to combat tuberculosis of the cattle cannot fail to be advantageous to every country.

TUBERCULOSIS AND MILK SUPPLY.

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As compared with other diseases to which man is liable, the one which must be recognized as deserving the greatest attention from sanitarians, health officers and physicians, is unquestionably tuberculosis, and no apology is needed for the giving of any facts, however small, which may add to our understanding of it or our power of preventing it. Tuberculosis, according to the best statistics, causes one-seventh of all deaths in man. It has destroyed more lives than all the wars and all the epidemics of cholera, small-pox and yellow fever combined. That it is on the decrease seems to be unquestionable, but it is a matter of the greatest importance to examine into the causes of its great prevalence.

Of all diseases to which the animals from which we derive our food are liable, tuberculosis is also most prevalent and the most far-reaching in its effects and it seems not unlikely that there is a close connection between the prevalence of the disease in man and in our food animals. If we examine into the geographical distribution of tuberculosis, we find that there is a close connection between the presence and absence of tuberculosis and the presence and the absence of healthy cattle. In Northern Norway, Sweden, Lapland and Finland, where reindeer constitute the bulk of farm animals; or about the Hudson Bay and in the islands of the Pacific, where no cattle exist; in the Scottish Hebrides, Iceland and Newfoundland, where there are only a few cattle, tuberculosis is far less prevalent in man. In Algiers the cattle are few, and live for the most part in the open air, away from cities, and it is found that tuberculosis does not increase among the natives. In Italy, on the other hand, where cattle are housed, Perroncito states that tuberculosis has become the scourge of man and beast (Law).

No disease known attacks more numerous genera of animals than does tuberculosis. The bovine species are the most susceptible, but the disease is found in chickens, guinea pigs, swine, rabbits and goats, and less frequently in caged apes, lions, kangaroo, deer, elk, gazelle, antelope, birds, and, in one case noted by Dr. Theobald Smith, a tame bear. Among the animals usually thought to be exempt, such as dogs,

cats, sheep and horses, the disease can readily be produced by inoculation.

It is, however, to the disease as found in milch cattle that we wish to devote our especial attention in this paper. Professor Law states that in some dairy and breeding herds in New York, consisting largely of mature cows, there is found as high as 98 per cent. of tuberculous animals. In the State of Pennsylvania Dr. Leonard Pearson has found a few herds in which every animal was afflicted by the disease. The disease, probably, did not prevail among American cattle to any extent, at least, until comparatively recent years. It has probably been favored by in-and-in-breeding, over milking, breeding too young, overtaxing, and other weakening effects, as the effort to supply the increasing demand for milk in our rapidly growing American cities has become greater; although, no doubt, the chief means of increase has been by direct infection from animal to animal.

The statistics of 1890 show that the number of cows in the United States was 16,511,950, yielding a total of 5,209,125,567 gallons of milk, or about 83 gallons per capita for each inhabitant. As milk can act as a carrier of the tubercle bacillus, what a fruitful source of the disease this enormous supply, if infected, must be! It has also been found in butter by numerous observers, and has been shown to maintain its life in that substance for upward of one hundred and twenty days; likewise, cheese has been found to contain it, and it is known to live in this substance for as much as thirty-five days. So even the manufactured products of milk may convey the disease, and, in some districts, we can look upon the total amount of milk produced as a possible conveyer of the tubercle bacillus.

The danger from milk was first pointed out by Professor Klencke, as early as 1846, who gave the clinical histories of sixteen children who had been fed from the milk of cows, some of which were stable-fed and some swill-fed, all of which pointed to tuberculosis either of the intestines, glands, skin or bone. This virulence of milk was confirmed by Gerlach in 1869, and later by others. The discovery of the tubercle bacillus by Koch in 1882 proved the possibility of what these men had found to be true clinically, and in the same year both Virchow and himself pointed out the possibility of the danger of infection of milk by the tubercle bacillus.

Among those who have given further clinical evidence of infection by means of milk, may be mentioned Dr. Stang, of Amorback, who mentions a case of a well-developed five year old boy from sound parents, whose ancestors on both sides were free from hereditary taint, who died after a few weeks' illness of acute miliary tuberculosis of the lungs and enormously enlarged mesenteric glands. A short time before the parents had had a milch cow killed and found her the victim of advanced tuberculosis. Brouardel cites a case where five out of

fourteen young girls living together in a boarding school became consumptive subsequent to the daily use of milk from a tuberculous cow (Pearman and Moor).

Dr. Demme records a case of four infants in the Child's Hospital, at Berne, without tuberculous ancestors, who died of intestinal and mesenteric tuberculosis, as the result of feeding on the unsterilized milk of tuberculous cows.

Professor Law states that after a lecture at Providence, Rhode Island, a gentleman of North Hadley, Mass., publicly stated that his only child, a strong, vigorous boy of one and a half years, went to an uncle's for one week and drank the milk of a cow which was shortly afterward condemned and killed in a state of generalized tuberculosis. In six weeks the child was noticeably falling off, and in three months died of tuberculosis of the abdomen. There was no tuberculosis on the father's side, but some on his mother's, although she herself was in perfect health.

Woodhead has recently stated "that from his experience in two large hospitals he has been much struck by the fact that in children who had died from other diseases during the course of tubercular disease of the abdominal gland, there was frequently not any trace of tubercular disease in any part, thus pointing to the intestine as a channel by which the bacillus made its way into the body." He also remarks that in a large number of cases of general tuberculosis, where the possibility of infection by the pulmonary passages was evidently excluded, the tuberculous process appeared to have invaded the body by the intestinal canal. These facts, taken in connection with the occasional existence of tubercle bacilli in milk, went far to prove in his opinion that mi'k was a source of tubercular infection, especially in young children. Woodhead found that out of 127 cases of tuberculosis in children the mesenteric glands showed tubercular infection in 100, and that there was ulceration of the intestine in 43. It is especially in children that this mode of infection occurs. In the adult, ulceration of the intestine is rare as a primary infection.

It is known that the primary seat of tuberculosis in children is so frequently in the intestines and their related glands, and milk forms so large and essential an element in the food of children, that we cannot avoid the conclusion that it is to them a frequent source of infection.

The full significance of the foregoing figures can be understood better by examining for a moment the evidence which has been gathered as to the hereditary transmission of tuberculosis. In children the opportunities for doing this are more or less limited, but amongst the lower animals there is constant and abundant material for observations on this point. Bolitz gives the following figures: Of 2,576 children who died at Kiel, 1873-89, 424, or 16.4 per cent. were cases of

tuberculosis. Before the age of four weeks there were no deaths from tuberculosis. From five to ten weeks 0.9 of 1 per cent; from 3 to 5 months, 8.6 per cent.; from 6 to 12 months, 18.3 per cent.; from 1 to 2 years, 26.8 per cent.; from 2 to 3 years, 33 per cent.; from 3 to 4 years, 29.6 per cent.; from 4 to 5 years, 31.8 per cent.; from 5 to 10 years, 34.3 per cent.; from 10 to 15, 30.1 per cent. (Long).

Nocard gives the following figures: At the abattoir in Munich, about 160,000 calves are killed each year. Of this number two only, in 1878, were found tuberculous, 1 in 1879, none in 1880, none in 1881 and 2 in 1882. At Lyons, Leclerc, who has studied this question particularly, has found in some 400,000 calves, only 5 which were tuberculous. Johne in Berlin has found 4 in more than 150,000. From the 1st of April, 1892, until the 31st of March, 1893, there were killed in the public abattoirs of Prussia 600,501 grown animals, of which 52,136, or 8.6 per cent., were tuberculous. During the same time 914,216 calves were also slaughtered; 446, or about 0.04 per cent. were tuberculous.

Saxony is perhaps more gravely infected with tuberculosis than any other part of Europe. In 1890 in all of the abattoirs of the kingdom 16.5 per cent. of all cattle were tuberculous. The proportion of calves which were tuberculous was only 0.04 per cent.

To still better understand the value of these figures it must be remembered that cows are very much more subject to tuberculosis than are the males of the bovine species. At Copenhagen in 1888, for cattle of all ages, the percentage of tuberculous ones was 6 per cent., while for cows, the proportion was 16 per cent. In England there is only one case on record of a calf being born with tuberculosis, and in other European countries of all calves slaughtered under one month old, not more than 1 in 10,000 is tuberculous.

It has been claimed that the bacillus of tuberculosis remains dormant in these cases until the animal becomes older, and then brings about its characteristic effects. But against this idea is the fact that these same animals are very susceptible to the experimental inoculation by the tubercle bacillus, so that the claim seems to be untenable. It must be admitted, however, that there are well authenticated cases in which tuberculosis is hereditary, such as those recorded by Johne, Malvoz and Brouwier and Czoker, but they are extremely rare, and the evidence shows most strongly that tuberculosis is an acquired disease, the bacilli gaining entrance to the system after birth and being derived from the discharges of older animals affected with the disease.

Direct evidence of the infection of adults by means of milk is wanting, and we should expect to find in such cases that primary tuberculosis of the intestine would be a common manifestation of the disease; but such is not the fact as shown by clinical evidence. That such infection does not take place in adults more frequently may, perhaps, be

accounted for to some extent, at least, by the fact that a strong, vigorous digestion seems in some measure to protect the consumer. Peuch fed a two-months pig in five days four and a half quarts of milk drawn from a tuberculous udder, and when killed after fifty-six days it was found quite sound. Four rabbits inoculated with the same milk all became tuberculous.

The infection of animals by means of tuberculous milk, either by ingestion or by inoculation, is beyond question, different observers all agreeing on the main fact, their percentages of successful inoculation merely being different. It was formerly taught, and is still held by some experimenters, that the milk does not contain the tubercle bacillus, and is therefore not infectious, unless there is coincident disease of the udder of the cow producing it. There is, however, very strong evidence against this opinion. Ernst found in 33 per cent. of the cows examined by him, in which a careful post-mortem examination was made, which showed that the animals were widely affected with tuberculosis, but that the udder was free from disease, that the milk contained the tubercle bacillus. In 1893, Theobald Smith showed that the tubercle bacillus may be present in the milk of tuberculous cows when the udder, so far as the naked eye could tell, was free from disease. Other observers have given similar results.

The most positive evidence, however, is given by inoculation experiments. Hirschberger, by inoculation of rabbits in the addominal cavity with the milk of 29 tuberculous cows, of which the udders were, or appeared, sound, produced tuberculosis 14 times. Bang inoculated from 63 tuberculous cows selected for their sound udders, and found the milk of 9 of them infectious. A subsequent microscopic examination showed the udders of 3 of these cows to be diseased, leaving 6 which gave infectious milk in which, even after death, no tubercle bacilli could be found in the udder. Ernst found 10 cows in 35 with infectious milk, though the udders were sound. Of 103 animals inoculated, 17 contracted tuberculosis, and of 12 calves sucking the cows, 5 became tuberculous. Drs. Smith and Kilborne found the milk infecting in 3 cows out of 6 with apparently healthy udders. Forty-four per cent. of the guinea pigs inoculated contracted tuberculosis: 1 in 5 from one cow, 8 in 10 from another, and 6 in 6 from a third. Professor Law gives his experience that 3 calves from healthy parents, sucking the apparently sound udders of 3 cows wth general tuberculosis, all contracted the disease. Galtier found, by inoculation, that milk may prove infectious in 60 per cent. of cases, and that the infectious qualities are greatest in lesions of the udder, and next with those affected with general tuberculosis. Baumgarten, Fisher and Wesener, in their food experiments were especially impressed with the resulting tubercular lesions of the intestinal mucosa, mesenteric glands, and liver.

It is also known that the primary seat of tuberculosis in children is

so frequently in the intestines and their related glands, and milk forms so large and essential an element in the food of children, that we cannot avoid the conclusion that it is to them a frequent source of infection.

Dr. Russell, Health Officer of Glasgow, is so impressed with the danger of tubucular infection by milk, that he regards the supervision of the milk supply as of at least equivalent importance with the regulation of the expectoration of consumptives, and as being a much more practicable matter of sanitary administration. He says: "There is no need for argument in reference to the milk of tuberculous cows. The facts are so universally accepted, and so grave, that the administrative effects shine through them. It is practically the Glasgow position—that a tuberculous cow must not be retained in a dairy. There is a remarkable consensus of opinion as to the influence of milk in disseminating tuberculosis, especially among the young. The pathologist finds that of the total deaths under ten years of age among the mass of people, about a third are due to tuberculosis, and the usual seat of the disease at that age points to food as the medium of infection. The prevalence of tuberculosis among dairy cows is notorious."

Dr. Martin, in the report of the Royal Commission on Tuberculosis, writes: "The milk of cows with tuberculosis of the udder possesses a virulence which can only be described as extraordinary; all the animals inoculated showed tuberculosis in its most rapid form." Dr. Woodhead, investigating for his own purposes the effects of unboiled milk, speaks in similar terms of this virulence of milk derived from tuberculous udders and inoculated into test animals.

These two observers examined the milk from a cow in which one-quarter only of the udder showed tubercular disease. They found the milk from the other three-quarters perfectly harmless on inoculation, but the milk taken from the four teats was to all appearances just as virulent as the milk from the diseased quarter. Butter, skim milk and buttermilk obtained from the milk of a cow with tuberculous udder all contained tuberculous matter, actively injurious to test animals. Dr. Woodhead calls attention in the same report to the rapidity with which tuberculosis of the udder spreads, and states that in cows constantly under observation he had noticed on several occasions during the interval between the fortnightly inspections carried on along with a veterinary surgeon, that the disease had become distinctly developed. He says: "It may be, of course, that the early evidence has been overlooked at the previous inspection; but whether this is the case or not the spread of the disease is so rapid as to afford very good ground for alarm. The very absence of any definite sign in the earlier stage is one of the greatest dangers of this condition." Both Dr. Martin and Dr. Woodhead insist that no tuberculous animal of any kind be allowed to remain in a dairy.

The identity of tuberculosis in cattle and in man seems to be beyond question, although the manifestations of it may differ at times to a great extent. A few cases showing direct transferrence of the disease from cattle to man by inoculation may be quoted.

Tscherning, of Copenhagen, attended a veterinarian who had cut his finger in making a post-morten examination upon a tuberculous cow. After healing, the wound began to ulcerate, and the finger was finally removed. Microscopic examination revealed a tuberculous process with the presence of the tubercle bacilli.

Pfeiffer attended a veterinarian thirty-four years of age, with a good constitution and without hereditary predisposition, who cut his thumb in making a post-mortem examination of a tuberculous cow. The wound healed, but six months later the cicatrix still remained swollen, and in the fall of the next year the man developed pulmonary tuberculosis, bacilli were found in his sputum, and death occurred two and a half years after the wound. Post-mortem examination revealed tuberculosis of the joint of the wounded thumb.

Professor Law quotes a case of a young veterinarian, a friend of his, who was inoculated in the hand while opening a tuberculous cow, and who suffered from a tumefaction of the resulting cicatrix, which showed tubercle bacilli.

To these cases may be added one which came under the observation of the writer recently. Dr. E., a veterinarian of Pennsylvania, cut the knuckle of his forefinger while making a post-mortem examination of a tuberculous cow. The wound healed badly, remained swollen, and showed a decided tendency to ulcerate. Removal of the cicatricial mass was practiced, and the tissues sent to me for examination. They showed typical tubercular lesions, with giant-cell formation.

Although it is manifestly impossible to try direct inoculation from animal to man, corroborative evidence may be had by inoculating animals from man. This has been done in numerous cases, only one of which, given by Professor Crookshank, will be quoted. He obtained sputum containing numerous bacilli from an advanced case of phthisis, the sputum was shaken up with sterilized salt solution, and injected into the peritoneal cavity. The calf showed illness in a few weeks, did not feed well, and had a slight cough. These symptoms increased, and death occured forty-two days after inoculation. Extensive lesions were discovered at the post mortem examination; extending over the mesentery from about the point of inoculation were hundreds of wart-like, fleshy new growths. There were similar deposits on the under surface of the liver, the spleen, in the gastro-splenic omentum, and on the peritonital surface of the diaphragm. Microscopical examination of the sections revealed minute tubercles disseminated through the whole section of the lungs and liver, and tubercle bacilli were found in these and in the peritoneal deposits. The calf died of pyemia, but

sufficient time had elapsed for marked local infection leading to generalized miliary tuberculosis.

For the past year the writer has carried out experiments bearing on the subject of milk infection, under the auspices of the Live Stock Sanitary Board of the State of Pennsylvania, at the Veterinary Department of the University of Pennsylvania. Five cows which reacted to tuberculin and showed physical signs of tuberculosis were obtained, the udders in every case being free from disease as far as a careful inspection could reveal. The cows during the experiment were kept under the best sanitary condition, were carefully fed, groomed every day, and given as much outdoor life in a paddock in the yard as possible. Guinea pigs were used exclusively, and the method employed was intraperitoneal injection. The milk was in no case centrifugalized; on the contrary, the whole milking was thoroughly shaken together before being used, the idea being to approach as nearly as possible the conditions which would be obtained from ordinary dairy milk. A single dose averaging 10 cubic centimetres was given. The results are given in the following tables:

SERIES A.

Number.	Date of inoculation.	Material used.	Died or killed.	Days under observation.	Result.
1	Nov. 26, ...	Herd milk, ..	Dec. 17, ...	22	No tubercular lesions.
2	Nov. 26, ...	Herd milk, ..	Jan., ...	......	No tubercular lesions.
3	Nov. 27, ...	Herd milk, ..	Dec. 17, ...	21	No tubercular lesions.
4	Nov. 27, ...	Herd milk, ..	Dec. 17, ...	21	No tubercular lesions.
5	Nov. 28, ...	Herd milk, ..	Dec. 2, ...	5	No tubercular lesions.
6	Nov. 28, ...	Herd milk, ..	Feb. 4, ...	68	No tubercular lesions.
7	Nov. 30, ...	Herd milk, ..	Dec. 8, ...	8	No tubercular lesions.
8	Nov. 30, ...	Herd milk, ..	Feb. 4, ...	66	No tubercular lesions.
9	Dec. 1, ...	Herd milk, ..	Lost.		
10	Dec. 1, ...	Herd milk, ..	Feb. 4, ...	63	No tubercular lesions.
11	Dec. 2, ...	Herd milk, ..	Dec. 7, ...	5	No tubercular lesions.
12	Dec. 2, ...	Herd milk, ..	Dec. 8, ...	6	No tubercular lesions.
13	Dec. 3, ...	Herd milk, ..	Dec. 4, ...	1	No tubercular lesions.
14	Dec. 3, ...	Herd milk, ..	Dec. 4, ...	1	No tubercular lesions.
15	Dec. 4, ...	Herd milk, ..	Dec. 9, ...	5	No tubercular lesions.
16	Dec. 4, ...	Herd milk, ..	Feb. 4, ...	62	No tubercular lesions.
17	Dec. 5, ...	Herd milk, ..	Jan. 28, ...	54	No tubercular lesions.
18	Dec. 5, ...	Herd milk, ..	Feb. 9, ...	66	No tubercular lesions.
19	Dec. 6, ...	Herd milk, ..	Dec. 10, ...	4	No tubercular lesions.
20	Dec. 6, ...	Herd milk, ..	Feb. 9, ...	65	No tubercular lesions.
21	Dec. 7, ...	Herd milk, ..	Dec. 12, ...	5	No tubercular lesions.
22	Dec. 7, ...	Herd milk, ..	Feb. 9, ...	64	Tubercular nodules in spleen.
23	Dec. 8, ...	Herd milk, ..	Jan. 27, ...	50	No tubercular lesions.
24	Dec. 8, ...	Herd milk, ..	Feb. 9, ...	63	No tubercular lesions.
25	Dec. 9, ...	Herd milk, ..	Feb. 15, ...	68	No tubercular lesions.
26	Dec. 9, ...	Herd milk, ..	Feb. 15, ...	68	No tubercular lesions.
27	Dec. 10, ...	Herd milk, ..	Dec. 14, ...	4	No tubercular lesions.
28	Dec. 10, ...	Herd milk, ..	Feb. 15, ...	67	No tubercular lesions.
29	Dec. 11, ...	Herd milk, ..	Dec. 16, ...	5	No tubercular lesions.
30	Dec. 11, ...	Herd milk, ..	Dec. 17, ...	6	No tubercular lesions.
31	Dec. 12, ...	Herd milk, ..	Dec. 21, ...	9	No tubercular lesions.
32	Dec. 12, ...	Herd milk, ..	Feb. 15, ...	65	No tubercular lesions.
33	Dec. 13, ...	Herd milk, ..	Dec. 27, ...	14	Tubercles in mesentery and liver.
34	Dec. 13, ...	Herd milk, ..	Jan. 4, ...	22	Tubercles in omentum and liver.
35	Dec. 14, ...	Herd milk, ..	Dec. 19, ...	5	No tubercular lesions.
36	Dec. 14, ...	Herd milk, ..	Jan. 27, ...	44	Tubercles in lungs, liver and omentum.
37	Dec. 14, ...	Sally, ...	Feb. 15, ...	63	No tubercular lesions.
38	Dec. 14, ...	Sally, ...	Feb. 15, ...	63	No tubercular lesions.
39	Dec. 15, ...	Sally, ...	March 1, ...	75	No tubercular lesions.
40	Dec. 15, ...	Sally, ...	March 1, ...	75	No tubercular lesions.
41	Dec. 15, ...	Herd milk, ..	March 1, ...	75	No tubercular lesions.
42	Dec. 15, ...	Herd milk, ..	March 1, ...	75	No tubercular lesions.
43	Dec. 16, ...	Herd milk, ..	Dec. 18, ...	2	No tubercular lesions.
44	Dec. 16, ...	Herd milk, ..	Dec. 18, ...	2	No tubercular lesions.
45	Dec. 16, ...	Sally, ...	March 1, ...	74	No tubercular lesions.
46	Dec. 16, ...	Sally, ...	March 1, ...	74	No tubercular lesions.
47	Dec. 17, ...	Sally, ...	March 1, ...	73	No tubercular lesions.
48	Dec. 17, ...	Sally, ...	March 1, ...	73	No tubercular lesions.
49	Dec. 17, ...	Herd milk, ..	Dec. 22, ...	5	No tubercular lesions.
50	Dec. 17, ...	Herd milk, ..	Dec. 23, ...	6	No tubercular lesions.

SERIES B.

Number.	Date of inoculation.	Material used.	Died or killed.	Days under observation.	Result.
1	Dec. 21,....	Herd milk,..	Jan. 29,....	39	No tubercular lesions.
2	Dec. 21,....	Herd milk,..	Jan. 29,....	39	No tubercular lesions.
3	Dec. 22,....	Herd milk,..	March 22,....	86	No tubercular lesions.
4	Dec. 22,....	Herd milk,..	March 22,....	86	No tubercular lesions.
5	Dec. 23,....	Herd milk,..	Dec. 30,....	7	No tubercular lesions.
6	Dec. 23,....	Herd milk,..	Feb. 6,....	45	Tubercles in mesentery, liver and spleen.
7	Dec. 24,....	Herd milk,..	Jan. 4,....	11	No tubercular lesions.
8	Dec. 24,....	Herd milk,..	March 22,....	86	No tubercular lesions.
9	Dec. 30,....	Herd milk,..	Feb. 3,....	35	Tubercles in liver and spleen.
10	Dec. 30,....	Herd milk,..	March 22,....	82	No tubercular lesions.
11	Dec. 31,....	Herd milk,..	Jan. 3,....	3	No tubercular lesions.
12	Dec. 31,....	Herd milk,..	Jan. 3,....	3	No tubercular lesions.
13	Jan. 1,....	Herd milk,..	Jan. 14,....	13	No tubercular lesions.
14	Jan. 1,....	Herd milk,..	March 22,....	80	No tubercular lesions.
15	Jan. 2,....	Herd milk,..	Feb. 5,....	34	Lesions in lungs and liver.
16	Jan. 2,....	Herd milk,..	March 22,....	79	No tubercular lesions.
17	Jan. 4,....	Herd milk,..	Same day, ..	......	No tubercular lesions.
18	Jan. 4,....	Herd milk,..	March 22,....	77	No tubercular lesions.
19	Jan. 5,....	Herd milk,..	Feb. 26,....	52	Tubercles in lungs and liver.
20	Jan. 5,....	Herd milk,..	March 22,....	76	No tubercular lesions.
21	Jan. 6,....	Herd milk,..	March 22,....	75	No tubercular lesions.
22	Jan. 6,....	Herd milk,..	March 22,....	75	No tubercular lesions.
23	Jan. 7,....	Herd milk,..	March 22,....	74	No tubercular lesions.
24	Jan. 7,....	Herd milk,..	March 22,....	74	No tubercular lesions.
25	Jan. 8,....	Herd milk,..	Jan. 27,....	19	No tubercular lesions.
26	Jan. 8,....	Herd milk,..	Feb. 24,....	47	Tubercles in liver and spleen.
27	Jan. 12,....	Herd milk,..	March 22,....	69	No tubercular lesions.
28	Jan. 12,....	Herd milk,..	March 22,....	69	No tubercular lesions.
29	Jan. 14,....	Herd milk,..	Jan. 16,....	2	No tubercular lesions.
30	Jan. 14,....	Herd milk,..	March 22,....	67	No tubercular lesions.

SERIES C.

Number.	Date of inoculation.	Material used.	Died or killed.	Days under observation.	Result.
1	April 7,....	Milk cow II,	June 28,....	82	No tubercular lesions.
2	April 7,....	Milk cow II,	June 28,....	82	No tubercular lesions.
3	April 8,....	Milk cow II,	June 28,....	81	No tubercular lesions.
4	April 8,....	Milk cow II,	June 28,....	81	No tubercular lesions.
5	April 9,....	Milk cow II,	June 28,....	81	No tubercular lesions.
6	April 9,....	Milk cow II,	June 28,....	80	No tubercular lesions.
7	April 12,....	Milk cow II,	June 28,....	77	No tubercular lesions.
8	April 12,....	Milk cow II,	June 28,....	77	No tubercular lesions.

SERIES D.

Number.	Date of inoculation.	Material used.	Died or killed.	Days under observation.	Result.
1	July 12,....	Herd milk,..	Oct. 9,....	89	No tubercular lesions.
2	July 12,....	Herd milk,..	Oct. 9,....	89	No tubercular lesions.
3	July 12,....	Boiled milk,	Oct. 9,....	89	No tubercular lesions.
4	July 12,....	Boiled milk,	Oct. 9,....	89	No tubercular lesions.
5	July 13,....	Boiled milk,	Oct. 9,....	88	No tubercular lesions.
6	July 13,....	Boiled milk,	Oct. 9,....	88	No tubercular lesions.
7	July 13,....	Herd milk,..	Oct. 9,....	88	No tubercular lesions.
8	July 13,....	Herd milk,..	Oct. 9,....	88	No tubercular lesions.
9	July 14,....	Herd milk,..	Aug. 16,....	33	No tubercular lesions.
10	July 14,....	Herd milk,..	Oct. 9,....	87	No tubercular lesions.
11	July 14,....	Boiled milk,	Oct. 9,....	87	No tubercular lesions.
12	July 14,....	Boiled milk,	Oct. 9,....	87	No tubercular lesions.
13	July 15,....	Boiled milk,	Oct. 10,....	87	No tubercular lesions.
14	July 15,....	Boiled milk,	Oct. 10,....	87	No tubercular lesions.
15	July 15,....	Herd milk,..	July 30,....	15	No tubercular lesions.
16	July 15,....	Herd milk,..	July 10,....	87	No tubercular lesions.
17	July 16,....	Herd milk,..	July 10,....	86	No tubercular lesions.
18	July 16,....	Herd milk,..	July 10,....	86	No tubercular lesions.
19	July 16,....	Boiled milk,	July 10,....	86	No tubercular lesions.
20	July 16,....	Boiled milk,	July 10,....	86	No tubercular lesions.
21	July 19,....	Boiled milk,	July 10,....	83	No tubercular lesions.
22	July 19,....	Boiled milk,	July 10,....	83	No tubercular lesions.
23	July 19,....	Herd milk,..	July 10,....	83	No tubercular lesions.
24	July 19,....	Herd milk,..	July 10,....	83	No tubercular lesions.
25	July 20,....	Herd milk,..	July 11,....	83	No tubercular lesions.
26	July 20,....	Herd milk,..	July 11,....	83	No tubercular lesions.
27	July 20,....	Boiled milk,	July 11,....	83	No tubercular lesions.
28	July 20,....	Boiled milk,	July 11,....	83	No tubercular lesions.
29	July 21,....	Boiled milk,	July 11,....	82	No tubercular lesions.
20	July 21,....	Boiled milk,	July 11,....	82	No tubercular lesions.
31	July 21,....	Herd milk,..	July 11,....	82	No tubercular lesions.
32	July 21,....	Herd milk,..	July 11,....	82	No tubercular lesions.
33	July 22,....	Herd milk,..	July 11,....	81	No tubercular lesions.
34	July 22,....	Herd milk,..	July 11,....	81	No tubercular lesions.
35	July 22,....	Boiled milk,	July 11,....	81	No tubercular lesions.
36	July 22,....	Boiled milk,	July 11,....	81	No tubercular lesions.
37	July 24,....	Boiled milk,	July 12,....	80	No tubercular lesions.
38	July 24,...	Boiled milk,	July 12,....	80	No tubercular lesions.
39	July 24,....	Herd milk,..	Oct. 12,....	80	No tubercular lesions.
40	July 24,....	Herd milk,..	Oct. 12,....	80	No tubercular lesions.
41	July 26,....	Herd milk,..	Oct. 12,....	78	No tubercular lesions.
42	July 26,....	Herd milk,..	Oct. 12,....	78	No tubercular lesions.
43	July 26,....	Boiled milk,	Oct. 12,....	78	No tubercular lesions.
44	July 26,....	Boiled milk,	Oct. 12,....	78	No tubercular lesions.
45	July 27,....	Boiled milk,	Oct. 12,....	77	No tubercular lesions.
46	July 27,....	Boiled milk,	Oct. 12,....	77	No tubercular lesions.
47	July 27,....	Herd milk,..	Oct. 12,....	77	No tubercular lesions.
48	July 27,....	Herd milk,..	Oct. 12	77	No tubercular lesions.
49	July 29,....	Herd milk,.	Oct. 12,....	75	No tubercular lesions.
50	July 29,....	Herd milk,.	Oct. 12,....	75	No tubercular lesions.
51	July 29,....	Boiled milk.	Oct. 12,....	75	No tubercular lesions.
52	July 29,....	Boiled milk.	Oct. 12,....	75	No tubercular lesions.

Summary.

Series A. Fifty pigs were used in this experiment, eighteen of which died within a few days of the injection, too soon for any signs of tuberculosis to have manifested themselves, and one was lost. Subtracting these, and considering only those which lived long enough for the disease to become manifest, we have left thirty-one animals, four of which were unquestionably tuberculous, a percentage of 12.9.

Series B. Thirty pigs were used in this experiment, six of which died before tubercular lesions could have become manifest. Subtracting these, we have left twenty-four animals, five of which were unquestionably tuberculous, a percentage of 20.8.

Series C. Eight pigs were used in this experiment, and the milk of a single cow was employed. One pig became tuberculous, a percentage of 12.5.

Eighty-eight animals were employed in these three series of experiments. Deducting those which died too soon after inoculation to show tubercular lesions, we have as a final result that 15.4 per cent of the animals became tuberculous from the single dose of milk. In all cases the most healthy pigs were selected, and the experiment ended with the death and careful post-mortem examination of the animal.

Series D. In this experiment fifty-two pigs were used. Two were inoculated daily with mixed herd milk, and two with the same milk after sterilization by heat. None of these animals became tuberculous. It has not seemed proper to include this series with the others, but the figures are given for the sake of fairness, and also because of the interest they bear. When this experiment began the cows had been under treatment about eight months, the treatment consisting in the use of large injections of tuberculin (5 to 10 c.c.) on an average of every three weeks. All had improved very much, and one had gained more than 150 pounds in weight. In these experiments it must be remembered that no attempt was made to collect the bacilli in a small quantity of fluid, but, on the other hand, they were distributed as thoroughly as possible before the inoculation.

From these and other like experiments it is fair to conclude that the number of bacilli in the milk of tuberculous animals varies from day to day, although it is possible that in taking 10 c.c. from the whole mass of milk, we may have missed bacilli which were few in numbers. Additional evidence has also been given to show that the bacillus of tuberculosis may pass into the milk of cows having general tuberculosis, but whose udders are perfectly healthy, so far as the most careful examination by competent veterinarians can show.

I have given in these pages only a part of the evidence that is at hand on the question; but enough has been said, I think, to show the soundness of the conclusions arrived at by the Royal Commission on Tuberculosis, that,

* * * * "As to the proportion of tuberculosis acquired by man through his food or through other means, we can form no definite opinion, but we think it probable that an appreciable part of the tuberculosis that affects man is obtained through his food."

And "No doubt the largest part of the tuberculosis which man obtains through his food is by means of milk containing tuberculous matter."

The remedy lies in the careful inspection of milch cows, and the immediate weeding out of all diseased animals found. Milk from suspected cattle should be carefully sterilized before using, and especially should not be given to infants and invalids. The inspections of the animals should be at intervals frequent enough to keep the disease from gaining headway before being discovered.

SPECIAL

EXAMINATIONS AND INVESTIGATIONS.

"The Secretary may, at his discretion, employ experts for special examinations or investigations."—Act of March 13, 1895—Section 6.

SPECIAL INVESTIGATIONS.

INVESTIGATIONS IN THE BARK OF TREES.

By PROF. THOMAS MEEHAN, *Botanist State Board of Agriculture, Germantown, Penna.*

The nature of the bark of trees, and the office of bark in the economy of plant life, are questions of great importance to the practical man. Considering their importance it is remarkable that so little attention is given to the subject in standard works on agriculture and horticulture. Whenever the subject has been introduced at conventions or gatherings of intelligent cultivators, it has resulted in displaying complete ignorance, or in inviting the shafts of wits, or volleys of ridicule. The author of this essay well remembers an instance where a merely practical man, but well known as an observant, successful fruit grower, detailed his method of helping "hide-bound" trees by longitudinal slittings in the bark. His remarks were received with guffaws. One learned disputant contended that we might as well talk of curing the rheumatism by slitting the flesh in a man's leg, while another in mock gratefulness extended his thanks to the presentor of the idea, as it had taught him that the trouble with a neighbor's night-barking dog was that he was hide-bound, and he could now remedy it by slitting up his sides. On another occasion, when some successful German fruit grower of Central Pennsylvania had described among his methods an annual coat of white wash over the trunks and branches of his apple trees, the statement was derisively received. There was a great deal of talk about pores in the bark—pores essential to plant breathing, the stopping up of which by the lime wash must certainly lead to injury. It was contended that success which had certainly followed this fruit grower's efforts were due to other conditions. Success followed in spite of the white-washing, they insisted. Great as had been his success, it would have been greater without it. It was, in their estimation, worse than labor thrown away.

If we take up works on practical gardening we find learned discussions as to the wisdom of scraping off the old bark of trees.

Bark, it is said, is given to trees for the purpose of protecting them from the hot sun in summer, or cold winds in winter, and it needs all the bark it can get. And again it would be argued that rough bark was a sign of ill health; and, as in the case of a sick man that needed more clothing to keep him warm, the old bark formed additional protection. Even those who saw health and productiveness in trees with smooth green bark, it would be finally concluded, mistook the coincidence for a cause.

Taking up works of a scientific character—text books on botany, and similar productions—we find comparatively little in relation to the nature and offices of bark. For all that we are taught in this manner, we are left to the conclusion that there is little practical difference between the bark of one tree and the bark of another tree; and that the clefts and rifts we see in old branches or trunks are simply the result of the mechanical law of expansion. As the wood of the tree increases in diameter the barky band has to give way from the internal pressure. The cracks occur in the weakest places. This is not actually taught, but it is the inference. The careful observer, however, notes that each tree has its own distinct character of bark, which would not be the case under mechanical expansion. One brought into practical acquaintance with trees could distinguish one kind from another though blindfolded, simply by feeling the trunk with his hand.

It must be evident, therefore, that there must be some general law operating to produce the infinite variety of bark which trees present, and that the investigation of the whole subject is a promising field of practical usefulness.

One cannot understand the nature of bark without a knowledge of how wood is formed, as bark is simply an outgrowth from the wood-cell, and is indeed the residuum, as it were, from the new annual wood layer.

Everyone understands that a new layer of wood is annually placed over the layer of last year, so that we can tell the age of a tree by the number of these concentric circles. But it is not strictly true that the new layer is placed there. It is the living tissue of last year that furnishes the material and really constructs the layer that forms the additional woody circle.

It was at one time supposed that wood was formed out of a mucous layer known technically as cambium, and which is found between last year's layer of wood and bark early in the summer. But this is now known to be but a store of food provided by the leaves and which is to furnish the material out of which the new layer of wood is to be formed. Woody tissue is formed of innumerably small cells, each of which is an individual in itself. A tree is simply an aggregate of individuals, which have united together for mutual protection, just as the individuals of a country unite to form a govern-

ment. In these microscopic cells the whole future character of the tree is hidden. Whether a tree is to be an apple, a pear, a peach or an orange, is all decided when the cell is formed. It is one of the most wonderful of all wonderful things in the history of nature that, though we may examine the structure and character of a single cell by the aid of the most powerful microscope, there still lie hidden life-problems of the most astounding nature, that will probably never be solved for us. A single cell may eventually develop to an orange tree or to an oak, but the strongest microscope fails to give us any forewarning of the fact.

These cells, which form the mass of wood out of which the tree is built, have only a single year of life. In our American deciduous trees they are born at midsummer, reach their full growth before autumn, carry along the chain of life till next midsummer, when they bring forth their young, and then die. This process is repeated year after year. The dead cells form the annual layers of wood. A tree is in fact but a huge mausoleum containing hosts of skeletons of the dead past.

It is extremely interesting to watch this process of cell-making, and the formation of the annual layer of wood. It can be observed without the aid of a microscope. Any tree will probaly answer. The observations made by the author of this paper were made in various years, on the common garden cherry, the cottonwood, and the apple. Early in the spring, as every boy knows who has made a whistle pipe, a watery liquid appears between the bark and the wood, which is the commencement of the separating process. By June this thin liquid becomes thick and somewhat viscid, and then is in its cambium state. If now the bark be entirely stripped from the branch or trunk and the exposed wood shaded a little to prevent evaporation, it will soon assume a greenish tint. In a few days numerous fine points equalling the sands of the sea in numbers, may be detected proceeding from the old wood, penetrating the cambium layer, getting larger and larger until they meet each other. This is the beginning of the annual woody layer. This all comes from the cells on the outside of last year's layer of wood. Each divides and forms two cells. These again divide and go on dividing with great rapidity, continuing the work for about six weeks, when the process of wood making comes to an end. All the annual increase in girth of trees in this climate occurs within this brief period, say from about the middle of June to the first of August. The trees experimented on by the author were the cottonwood and the silver maple. The rapid growth of these species make them favorable for such observations. Trees about twenty years old are best for the purpose, as the daily increase in girth and its total cessation are easily noted.

Before the wood in these bark-pealed branches makes its final

effort at growth, we may note a marked change in its earlier characteristics. It is yellowish and spongy. Before the end of the growing period, we come to understand what has been going on. When the food prepared by the leaves as cambium is nearly exhausted, and the cells by continual reproduction have lost a part of their vital power, what would have been wood under more vigorous conditions, is simply bark. The postulate may be presented that fibre or bark cells are simply a degradation of wood cells. Both have precisely the same origin.

Sometimes, however, a cell objects to being degraded. It prefers to remain a wood cell. In this case it continues to reproduce itself as a distinct organization from the main trunk, making its own wood and bark annually as in its former history. Then we have the knots or burs, as these excrescences are popularly called, on the trunks of trees. They are very common in the weeping willow. In the cherry tree they are often so numerous and in old trees so large that one may almost use them as steps for climbing the tree. Figure 1 is an illustration of a cherry bur. It is a vertical section and shows the annual rings of wood, just as in the parent trunk. Eight or nine years before, when the bark cells were being formed out of the fibrous tissue, one cell remained attached to the main body as a wood cell. It then continued to make its own bark and circles of wood annually, just as the main stem was doing.

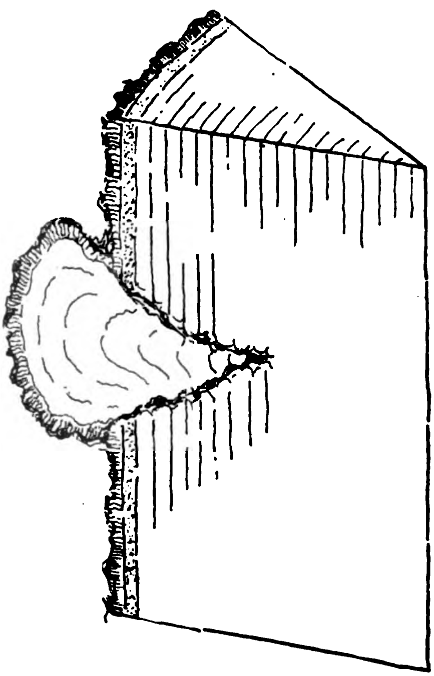


Fig. 1. Excrescence or bur on trunk of a cherry tree.

A careful study of this cut will enable us to understand, what often seems mysterious, the presence of bark within the wood of trees. The bark formed by bur or knob, as it increases in size annually, is covered by the annual deposit of wood in the main trunk though compressed considerably from the growth-pressure of the cells. In the wistaria, hornbeam, and especially in those sub-tropical leguminose plants known as bauhineas, bark is found abundantly within the wood of large stems. A careful examination of the annual deposits of wood will show that this has resulted from irregular growth of the wood cells. In some portions of the trunk a set of cells has ob-

tained more nutrition than others, and thus able to make more vigorous growth than neighbors to the right and to the left of them. There was nothing left to do but to spread to the right and to the left, just as the excrescence would do, overlapping the weaker growing wood and bark on each side.

In these cases, however, the production of an annual layer of bark still goes on, though compressed frequently into a very thin line, and this prevents the perfect consolidation of the wood such as is accomplished in grafting, in which process the growing cells in the scion and stalk unite before the bark cells are formed. This will explain some peculiar marks on the trunks of trees that often attract the attention of the curious. For instance in figure 2, which is a portion of a trunk of the canoe or paper birch, at A starts a rough line of dark black color which forms a V shaped hood over a large wound, b, now nearly covered by new wood and bark—nearly healed, as we say in forestry practice. Again there is another rough black line starting upwards at d and ending at c. For many years these peculiar marks on trees were a mystery to the author. They could not be explained by an exposition of the manner in which wood and bark was explained in the text books. When understood as explained in this paper, the manner of formation is clear: Some years back the tree had forked at d. As the branches forming each prong increased annually and came nearer together, the bark kept the woods of each from uniting, so that the fork appears to start some twelve inches above the point, and much further to the left, than it did in the first instance. This happens to be very clear in this case, but in many instances the explanation is not so apparent. In the inverted V shaped mark originating at a, for instance. All included within the V line is wood belonging to the branch that has since been cut away. The original starting point of the branch was on the line of a, but growing at an acute angle, and the growth of the stem covering the base of the side branch makes the difference. In brief, an inch of the lower portion of the side branch is imbedded in the wood of the main stem.

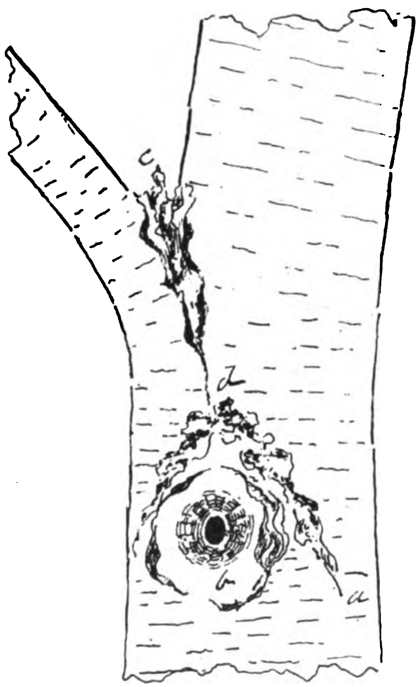


Fig. 2. Bark enclosed by the annual deposits of wood.

We now come to an examination of bark in its separate state of existence from wood. The outer layer of wood is the last formed of that division of the tree structure, while it is the inner layer of bark that is the one most recently constructed, the outer layer having been the inner bark of many years before.

A remarkable feature now strikes the careful observer. While there is reason to believe, as already noted, that wood cells have little more than a year of life, that in fact a tree trunk is little more than a mass of skeletons of what were once cells full of life and activity, the bark, though ushered into life under a low degree of vital power, seems to have an indefinite period of active existence. Every one knows the difference between live and dead bark. If in the spring we desire to know whether a tree transplanted in the fall has got through safely or not, we simply scratch the bark. If it is brown, the bark is dead—if green and sappy, we know it is full of life.

So with trees of various ages. The outer bark is not dead as long as we find it will stand the above test. As a general rule the external coating is alive as long as it is known as smooth bark. When it reaches the condition of rough bark, the outer coating consists of dead material.

The age at which trees take on the rough bark varies with the species. In the common sweet chestnut *Castanea Americana*, the bark continues to retain life, and thus preserve its smooth condition until it is about 25 years old. The European form, *Castanca Vesca*, probably retains for about the same time, the same conditions, but the exact period has not been closely calculated. Most of the oaks begin to show the presence of rough bark at about ten or eleven years, and the apple about the same. The sassafras has rough bark two or three years after its first formation. Some poplars start to exhibit rough bark very early in life, as for instance the abele or silver poplar; the gray poplar presents this condition later, while the class known as aspens do not have rough bark until very late in life. Some, as the beech, for instance, seem never to have rough bark, but in these cases it is not from the bark having had a long lease of life, but because of the casting off of the epiderm very early in life. The bark of the beech tree, full of life as it would seem, presents a thinner layer in old trees than almost any other tree. It seems a mere papery shell.

When we take for examination a twenty year old trunk of a sweet chestnut tree of perhaps nearly a foot in diameter, and note that the outer bark is actually the same layer that encircled the branch when it was but an inch thick, we may wonder why the bark did not crack by the pressure of wood-growth from the interior. This thought occurs to us in connection with all trees. Indeed, some text books have taught that the bark of trees is disrupted mechanically by the

pressure of wood-growth from the inside. The example furnished by the chestnut shows that this is not the case. As long as there is life there is elasticity in the tissue, and it becomes in a measure netted--veined.

By reason of this the annual layers of the chestnut tree are thinner on the outside than those in the interior next to the wood. Only for this arrangement the bark of a twenty year old chestnut tree would be of enormous thickness. In some trees the netted character of the bark, after expansion as stated, presents a pretty piece of nature's handiwork. The linden, especially, is beautiful in this respect. In the West Indies there is a species that behaves so prettily in this respect that it is known as the lace-bark tree. Botanically it is *Lagetta lintearia*. One of our own native shrubs, *Dirca palustris* or leatherwood, presents us with a bark of a similarly woven character, though on a minor scale. Figure 3 represents the expanded bark of the West Indian lace-bark tree.

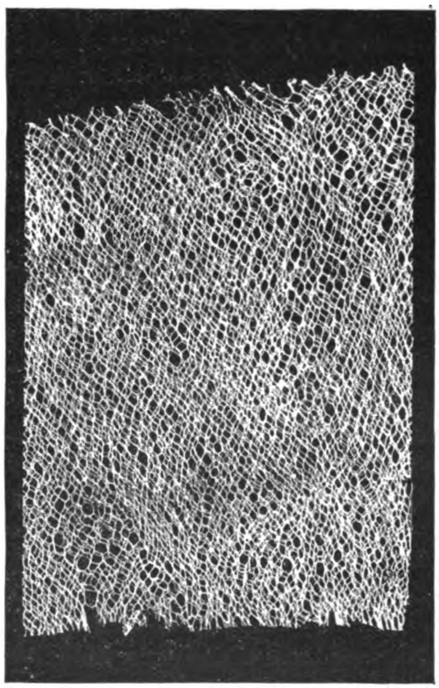


Fig. 3. One of twelve annual layers of bark from twelve year old branch of the Lace-bark-tree-*Lagetta lintearia*.

If, then, there be no cracking or rifting of the bark while it has a hold on life, how does the rough bark originate?

The first striking thought, on examining different kinds of trees, is that no trees have exactly the same character of rough bark, any more than have the rough bark appear at the same time of life. But each tree of any one species has precisely the same bark characters. One accustomed to noting the peculiarities of trees can determine the species almost as well by feeling the trunks in the dark, as by examining the leaves or fruit in the day time. The swamp white oak, for instance, *Quercus bicolor*, has a somewhat scaly bark. So has the white oak, but the scales of the white oak are in longish strips and comparatively thick, while those of the swamp white oak are thinner and rounder. The mossy cup oak has deep fissures, but the ridges are soft and yet roughish; while the common chestnut oak, *Quercus montana*, has deep fissures, but the ridges are broad, hard

and with a smooth surface. The old bark of the black oak, *Quercus tinctoria*, is broken into numerous small ridges, and these ridges usually separated by transverse divisions,—while the bark of the red oak continues smooth and riftless to a late period of life. It is also late in life before the royal oak, *Quercus Robur*, assumes the rough-bark condition. Other trees, such as the beech and cherry, form rifts horizontally, and the bark is thrown off in sheets running round the branch. Then there is a class, such as the planes or buttonwoods, and various species of thorns and the apple tree, as in Fig. 4, which forms its rough bark in scales or plates, which it is continually throwing off, apparently with no regular rule as to time or manner. Still others are covered wholly or in part by corky layers, giving the tree a rough and jagged appearance in connection with its bark arrangements. In this we find the cork oak; the sugar berry or celtis; the wahoo, and other elms; and more or less in many trees. All these peculiarities could not be so remarkably individualized if the rough bark of trees resulted from mere mechanical law of internal pressure. The rifts would be irregular, and the faster growing branch would have a different character of rifts than would the weaker one growing on the same tree. There must be a definite law operating in each species of tree, to produce this specific uniformity in each case.

It would appear that nature has little use for bark after it has performed the work that was given it to do, the chief of which must be the protection of the moist cambium layer during its early liquid state. Only for this protection it would evaporate faster than it could be formed. This is evident by watching the results of stripping off the entire bark in early midsummer, as already referred to, when the old mother cells send the daughter cells into the prepared cambium liquid, and in a few days form an absolutely new layer of wood and bark over the whole wound. Shade has to be provided to insure the success of this effort of nature. If exposed to hot sun or dry winds the new wood and bark is successfully formed only in patches. We learn from this that protection of the cambium layer is the chief office of the outer bark. In some works it has been taught that the office of the rough bark is protection from cold, and that it must be an injury to remove it. But when we understand that the chestnut and other trees cited will retain their smooth bark for ten or twenty years, and these smooth-barken branches get through severe winters as easily as those clothed with the rough bark, it requires no argument to prove that this reasoning is very far fetched.

The fact is, nature provides, from the earliest formation of the bark, machinery for the destruction of the bark when it is no longer of any service. This provision is in creating cork cells, which, when the proper time comes, develop in various directions, each species of tree bearing its own character of cork-cell growth, and thus giving the

peculiar individualized character of rough bark already noted. These cells are sometimes referred to in elementary works as suber cells. In some cases they are termed lenticels. In the earlier stages of the growth of branches these lenticels give the bark a freckled appearance, and it is from this that the term lenticel is derived. Their true nature, until the publication of this paper, has not been reported. All that has been said of them is that they are mere vent holes by which the plant can exchange a little exhausted air for a new and fresh supply. It is only during recent years that it has been noted that cork is one of nature's destructive agents. The fall of the leaf is due to the production of cork cells at the disarticulating point; and whole branchlets, as in the oak and arbor vitae, are separated and thrown off by the same mighty power. These cells, as already noted, are formed at the earliest period of stem structure; but they do not journey on their destructive errand until nature desires to remove some part that is no longer of any service. It is because they do not develop in the chestnut branch in its earliest stages that the bark continues smooth. When they do start to grow, they progress in different directions, usually taking a course in line with the direction of the branch. This is particularly evident in those oaks which have deep rifts in the rough bark. When these cells start their rapid development they meet each other eventually, and the rift is complete. After that the mechanical law comes into play, and the rifts get wider by the interior pressure as the trunk increases in girth. In some trees, however, the cells develop transversely. When they meet each other, the bark then peels off in sheets around the trunk. This is seen in the birch in Fig. 2. In that comparatively young specimen though the early lenticels have developed to straight lines, they have not yet reached each other, and the paper-white layer is still intact. In Fig. 4, which represents a middle aged cherry tree the lines have reached others, and have had sufficient lateral influence to deaden the cuticle, which then cracks vertically by the mechanical

Fig. 4. A Cherry tree with peeling bark.

pressure from the interior, and the bark is peeling off in irregular flakes. In the sycamore or buttonwood the cork cells develop beneath the outer cuticle, radiating in every direction, though with variable energy, and in this way the destruction results in irregular plates of dead bark. This is the manner in which also the cork cells are developed in the apple tree, as illustrated in Fig. 5, representing a large branch of an apple tree. The development is so irregular in this case that portions of the bark are thrown off in different years. The lighter patches are when the bark of last year was thrown off. The cracked and more rugged portions of the surface will be thrown off before the close of the present season, and next year will appear as the lighter patches do now. On the surface of the lighter spots are small protuberances. These are miniature woody excrescences as described in Fig. 1, but they are so weak that they do not increase faster than the normal wood and bark grows. They may in time become wholly imbedded in the regular woody tissue, and then we have the peculiar formation of wood which is so familiar to us as "bird's eye maple." Figure 6 shows the manner in which nature gets rid of the bark in the pear tree. I my studies in the formation and place in nature of bark, I have often been struck by the similar behavior of cork cells, and of some destructive fungi, when in a condition of active development. I am often led to believe there is a closer relation between them than is generally suspected. This suggestion is particularly prominent when we consider the decortication of the pear. Here, as in the apple, the cork cells develop beneath the surface and at irregular seasons, but the destructive agency extends almost to the last year's layer of the inner bark, and does not separate it from the inner layer as happens in the apple. Being killed, however, it separates from the still living portions on the boundaries by shrinkage, leaving a

Fig. 5. An apple branch of moderate age.

deep and very narrow chasm surrounding its field of operations. The dead portion curls up in drying, and thus is forced off eventually by purely mechanical law. This is so exactly like the operations of some parasitic fungi that only for the fact that we may naturally look for some extreme of the method adopted in the apple, that we conclude to have found this extreme in the apple's closely related species, the pear. I am the more inclined to believe that we are here on the borders of fungi land, from the fact that washing the trunks of pear trees with whale oil soap evidently retards the development of the cork cells, just as it does in the development of parasitic fungi.

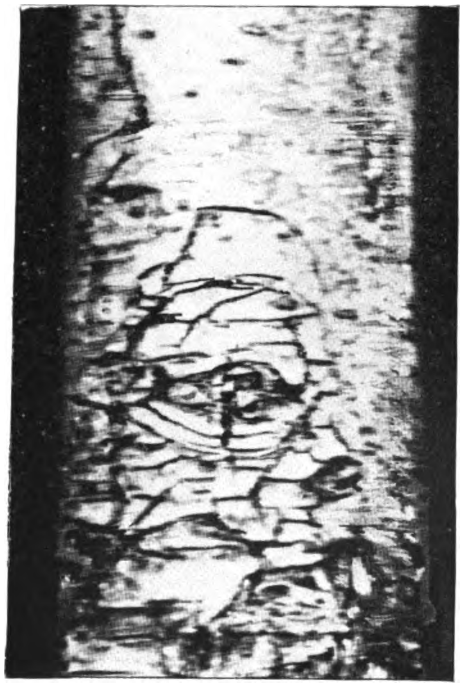


Fig. 6. Main stem of a 12 year old Pear tree.

It has been noted how, in some cases, bark seems to retain an extended lease of life, as in the case of the chestnut bark, and that in such cases the bark acts in some manner as leaves would in the general good economy of the plant. In some cases, indeed, plants have not other leaves than such as appear as bark, surrounding the woody tissue of the stem structure. The cactus family is an illustration. The plant consists wholly of bark and woody stem. A new layer is formed every year in the cactus plant, just as in other plants,—a new layer of wood in the exterior and of bark on the interior of the old layers respectively. When the cactus plant dies, and the bark is removed, this is evident. Not a particle of bark tissue is attached to the wood. There are no leaves, except the minute apices of leaves in a very early stage in a few instances. The whole leaf structure, which theoretically we associate with plants in general, has been retained as bark, the life of which is of the most enduring character. This longevity is due to the utter absence of lenticels in the structure of the cactus bark. It was not the purpose of nature to introduce these death-providing elements here. It was the purpose to provide a succulent coating for the wood, and an epiderm that should be able to resist transpiration. Cork cells here, with their destructive powers, would defeat the object, hence they are wisely wanting.

The union of leaves so as to form a succulent coating of bark, as we see it in cactuses, is a power not confined to cactuses, and other plants only, but occurs in parts of plants usually devoid of succulence. It is very common in the form of fleshy fruits, notably the apple and the pear. In many of these instances the transformation from bark in its normal condition to that of the succulent clothing of the fruit has been so imperfectly formed that the lenticels are still present, though their powers of development have become abridged. Nature has little use for them here, trusting to genuine forms of microscopic fungi to perform the duty of inducing decay. Still, where the lenticels are present, even in a somewhat obscure condition, use is made of them. This is evidenced in the apple. Some of these are known as russets, from the brown, rough condition of the surface. This is wholly the work of minute cork cells, which have developed to such an extent as wholly to destroy the epiderm or outer cuticle. In many kinds of apples these latent cork cells can be seen as very white specks on the apple skin. In most cases they continue dormant to the end. In the case of the russets they start to extend very early and the whole cuticle is destroyed by the time the apple is full grown. The scurfiness of a russet is due to the fine, dead skin by which it is covered and which was destroyed by the growth of the corky element. It is very interesting to watch this process in the growing apple of a russet variety. It is at first green, the lenticels seem to open, and the tiny brown spots soon meet each other and cover the whole surface of the skin.

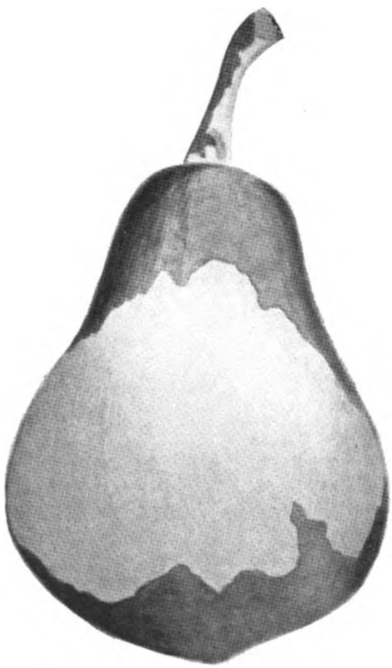


Fig. 7. Bartlett pear, half size, the dark lines marking the regular progress of the russetting over the yellow skin.

Like all things in nature, where nothing seems exempt from variation resulting from different degrees of life-energy, the development of cork cells on the rind of the apple and pear varies in intensity. In some cases they develope partially only. Then we have simply a little russet on one side of the pear or at the base of an apple. Occasionally there is exhibited a sudden spurt of extra energy, when we have a russet appear on fruits or parts of fruits in an apparently indiscriminate manner. An apple will appear with its lower half

russet, with the upper of the normal green. The author of this paper has seen an apple in which one-fifth of its longitudinal section was russet, the other four sections of the regular green tints. Fig. 7 represents a Bartlett pear which early in the season undertook the development of its cork cells, and clothed itself with russet, and by September had reached the stage illustrated here. The development and gradual extension of the cork cells, destroying the cuticle, and producing the russety surface, could be readily traced by the aid of an ordinary pocket lens. It furnishes one of the most instructive lessons in morphology, that the fleshy coating of the apple or pear is of the nature of a branch with its usual quota of cork cells in its outer bark, which when the proper order of business in the life of a plant is reached, becomes the agent of destructiveness to parts no longer needed. And the development in what seems to be unusual cases is again only what is an experience of every day life that in the most orderly assemblages there will be now and then instances of disorder.

Although I offer these results of my personal investigations as an original contribution to biological science, I have not forgotten that they are to be read chiefly by the practical agriculturist, to whom the use of unfamiliar scientific terms would render the points unintelligible. While this will make the treatise less acceptable to the student, to whom the language of science means a clear perception of the writer's thought, the paper may be more directly useful.

The main idea has been to show the tree grower that old bark is of no value to a tree—that nature herself has provided means wherewith to get rid of it when no longer useful,—and that the practical man may render himself good service by trying to aid nature in getting rid of a useless article.

Washes for the bark of trees will, therefore, in many instances, be eminently useful.

NOTES UPON GARBAGE FERTILIZERS.

By Dr. William Frear, *Chemist of the Department, State College P. O., Pa.*

One of the most perplexing problems confronting the sanitary engineers of our larger cities is the economical disposition, with safety to the public health, of those house wastes unfitted by their bulk for introduction into the sewers and removal by flushing. These wastes include furnace ashes, waste paper and kitchen refuse. The difficulty in the handling of the first two wastes arises from their weight and bulk, but in the case of kitchen refuse, highly fermentable and offering a ready feeding room for injurious germs, there is an added element of danger to public health. Ashes by themselves can readily be used for filling and grading low spots about the city, but for this use they should contain very little kitchen refuse, any excess of which would make the new ground a menace to health. It is customary, therefore, in all larger cities attempting to provide for the systematic removal of these wastes, to require that the ashes and kitchen refuse be kept in diffenent receptacles in order that they may be separately disposed of.

Confining our attention to the kitchen waste, we note that it is chiefly composed of food scraps, raw or cooked. The thought is immediately suggested that the most economical utilization of such materials is by feeding them to domestic animals, especially poultry and hogs. In thinly settled districts and small villages this is practicable, and is the method commonly followed.

The maintenance of extensive or numerous piggeries in or near large cities has been very thoroughly proven to give rise to extensive and dangerous nuisances. It is conceivable that this is not a necessary condition, but police regulations have not, in past experience, been sufficient to regulate and abolish the nuisance, even when quite rigidly enforced. As a consequence, this method of disposing of garbage has recently been abandoned by the city of Philadelphia, as it had earlier been in other large cities of the country.

Before considering the methods now employed for getting rid of the waste material, a word may be said concerning its quantity. Few figures are at the writer's command giving direct results of experience. In a paper presented, several years ago, before the Franklin Institute, Dr. Bruno Terne stated that the daily accumulation of garbage in Philadelphia varied from 125 tons in winter to 500 tons in

summer, and might be safely averaged at 250 tons per day for the whole year. Of this material, 80 per cent. is water, 15 to 16 per cent. organic matter and 4 to 5 per cent. mineral matter. Estimating the amount of waste for each individual of average maturity in a year, the amount is placed at 45 lbs. of dry matter, corresponding to 225 lbs. of garbage, 34.7 lbs. of organic matter and 10.3 lbs. of mineral constituents.

Estimates may be made by another method. Prof. Atwater, of the Storr's Agricultural Experiment Station, has had a careful determination made of the kitchen waste in a number of families. He states that the average waste of organic matter is about 34.5 grammes daily for each man; assuming that this would contain about the same proportion of mineral matter as was found by Terne, the total waste would be 45 grammes per day, or 35.8 pounds of dry matter per year. This result agrees as well as could be expected with Terne's figures.

As the garbage is rich in fat, in nitrogen and in mineral matter derived from plants and animals, it offers a raw material worth considering with reference to its industrial utilization.

Owing to its ready fermentability, some have regarded the only safe method of disposing of this waste in large cities to be that of cremation. By this process the garbage, if a proper system of collection is maintained, is quickly and very effectively rendered harmless. The method has, however, certain serious drawbacks. The fat and nitrogen, the most valuable constituents of the garbage, are entirely detroyed, leaving only the small residue of ash to pay for the labor and fuel. The ash which remains is a very incomplete fertilizer, not rich in any ingredient and not of more than medium availability.

An analysis of the earlier product of the American Incineration Company, of Philadelphia, made by Dr. Terne, and another made under the direction of the writer in the laboratory of the Pennsylvania State College Agricultural Experiment Station of material purporting to be produced by the cremation of garbage in Pittsburgh, will serve to give some idea of the composition of the ash produced:

	Phos. acid. Per cent.	Potash. Per cent.	Sand.
American Incinerating Co., Terne,	15.32	.25	.....
Pittsburgh garbage ash, ...	2.59	1.02	57.18

It is evident that the Pittsburgh product contained not only kitchen refuse, but also furnace ashes. If the product from kitchen waste, as analyzed by Terne be alone considered, it is apparent that it must be rated as a low grade phosphate fertilizer, not fit for acidulation. The potash of the garbage has probably been driven off by the high heat used in the crematory. The fertilizer compares fairly with that mined on the banks of the Pamunkey river, Va., and sold under the name "Natural Plant Food." It is fit for transportation for short

distances and can be used to advantage in considerable quantities upon orchards and grass lands. The Pittsburgh product, if it is correctly represented by the analysis quoted, is too dilute with worthless material to bear any long hauls at present prices of South Carolina floats, as much phosphoric acid as is present in the first sample whose analysis is given above, can be bought for $3 to $4, while the phosphoric acid and potash equivalent to the Pittsburgh sample should cost less than $2. According to the estimates given above, the city of Philadelphia could yield 12.5 tons a day, or 4,500 tons a year, worth at most $18,000, a sum insufficient to give any large profit to the contractors.

Because the cremation process results in the destruction of the more valuable constituents of the garbage, it is being supplanted in many of our cities by processes which aim at the utilization of these constituents without any greater menace to public health than is involved in cremation.

Dr. Terne's process involves the removal of the fat from the garbage by extraction; the sludge is evaporated to dryness, leaving a residue known as garbage tankage, useful as a fertilizer. This process, therefore, results in two primary useful products—fat and fertilizer.

The fat produced requires refining, but yields 75 per cent. of a very fine oil. The refined grease is an excellent soap stock. Dr. Terne gives no exact statement of the amount of crude grease removable by extraction, but his data imply that the amount is not less than 3 per cent. of the raw material. If Dr. Atwater's figures for the composition of kitchen waste can be applied, and if the grease extraction is at all perfect, the amount of fat obtainable from the garbage would be 6 to 7 per cent. of the raw material. This means that the garbage from Philadelphia would yield daily from 8 to 15 tons of crude grease, or 3,000 to 5,400 tons per annum, or from 6 to 15 pounds of fat for each inhabitant. The writer has no basis for estimating the cash value of this grease, but it is certainly far beyond that of the ash produced in cremating the garbage.

The garbage tankage having been heated to the boiling point of water for a long time in the course of evaporation, is probably sterilized so as not to be a means of spreading disease germs.

Dr. Terne claims a yield of garbage tankage equivalent to 17 per cent. of the wet garbage, or 15 per cent. at the lowest. This corresponds to 37.5 tons daily from the city of Philadelphia, or 11,250 tons yearly. The writer has had no opportunity for examining this fertilizing material, but Dr. Terne, from analyses of his own manufacturing product and of similar products from Detroit, Providence and elsewhere, gives the following statement of the range of composition observed:

	Least. Per cent.	Highest. Per cent.
Nitrogen,	2.9	3.7
Phosphoric acid,	3.0	6.0
Potash,	0.25	0.50

The materials recently placed on the market by the American Incinerating Company seems to be prepared by this more economical method, as indicated by its composition. Two analyses are at hand, one made by Dr. W. J. Gascoyne, of Baltimore, and one made in the Station laboratory:

	Gascoyne. Per cent.	Penna. Station. Per cent.
Moisture,	...	3.65
Phosphoric acid, total,	2.69	3.02
Phosphoric acid, soluble,	...	.26
Phosphoric acid, reverted,	...	1.00
Phosphoric acid, insoluble,	...	1.76
Potash,	0.66	.27
Nitrogen,	2.52	2.12
Chlorin,	...	trace.

At present rates of valuation, these low grade fertilizers would be given a rating of $16 to $20, a price undoubtedly too high for this material, much of which is only moderately available. Even at $10 per ton, the product of Philadelphia would be worth more than $100,000 yearly. The fertilizer thus produced, being practically a nitrogenous fertilizer, could be used to advantage in supplementing the use of plain superphosphates or rock and potash. There would be few cases in which it would be used economically as the sole fertilizer for a crop.

There remains to notice the product of a third process. Mr. Nathaniel B. Powter, of New York, received, in December, 1894, letters patent for a process as follows: The garbage is reduced to a sludge by steaming or boiling, with or without the use of sulphuric acid; the grease is removed by skimming; phosphate of alumina or lime is added to the sludge, and the latter is then converted into a dry granular mass by stirring and evaporation in a vacuum.

The weight of product by this process is, of course, increased by that of the phosphates added; no figures are given, however, stating how much acid and phosphates are employed nor what the total yield from a given weight of garbage is.

A sample of the product was submitted to the Department of Agriculture by the company operating under the patent, and analyzed in the Experiment Station laboratory with results as follows:

	Station analyses. Per cent.	Composition claimed by manufacturers. Per cent.
Water,	4.55	10.0
Phosphoric acid, total,	9.87	11.0
Phosphoric acid, soluble,	1.64	...
Phosphoric acid, reverted,	5.32	...
Phosphoric acid, insoluble,	2.91	...
Potash,	3.30	2.0
Chlorin,	.64	...
Nitrogen,	1.72	2.1

This analysis shows the material submitted by the company to be a well-balanced, medium grade fertilizer, such as would now be valued at about $27 per ton. The sulphuric acid has not been used in quantity sufficient to make water-soluble all the phosphate added, but more than two-thirds of it exists in readily available form. The quantity of potash is so high, relative to the nitrogen, as to indicate that the amount of potash in the garbage is supplemented by additions of potash from other sources; of the potash present, fully three-fourths is present as potassium sulphate.

The percentage of nitrogen is less than half that observed when garbage is, after the removal of the fat, dried down without any additions of foreign matter. This would indicate that the additions of solids in the form of sulphates from the sulphuric acid, phosphate and potash salts must be not less than 45 lbs. for every 225 lbs. of garbage, or 40 lbs. to the ton. And, finally, the nitrogen is present in the finished product, chiefly in organic combination, very little being present in the form of ammonium salts and none as nitrates. Evidently the process was conducted under such conditions of dilution of acid and at such temperature that the organic compounds were very slightly, if at all, affected by the acid. No such conditions were maintained as are employed when leather scrap, hair and similar materials are converted by sulphuric acid into much more available nitrogenous compounds.

The fertilizer produced by this process is, therefore, an important addition to the list of materials at the command of the farmer for use in restoring to the soil the plant food removed by the sale of farm products. It is also an important addition to the ever increasing number of valuable products rescued from the waste of past generations.

In closing, one word is probably due with regard to the claims made by the American Reduction Company, manufacturers of this product. In a comparison of their goods with that produced by mixing ordinary dissolved rock, sulphate of potash and animal matter, they claim great virtue for their own goods because it contains 49 per cent. of purely

carbonaceous matter as contrasted with 3 per cent. in the ordinary goods, and less than 10 per cent. of sulphuric acid, which, they claim, is very injurious when in excess, as contrasted with 30 per cent. present in ordinary goods. On the other hand, of the lime which is present as gypsum or plaster in the ordinary grade to the extent of 27 per cent., but in their own to the amount of less than 1 per cent., they say "it is not wanted because always present." Concerning these claims it may be said that sulphuric acid present in combination as plaster (the form in which it exists in ordinary super-phosphates) has not been found to be injurious in the quantities used in such fertilizers. It is certainly as likely to be useful as the preponderance of humus found in the garbage fertilizer. In comparing the two kinds of goods, therefore, assuming the guarantees as to nitrogen, phosphoric acid and potash to be identical, and the physical condition to be equally good, preference should be given to the cheaper.

COLORING MATTER IN CONFECTIONS.

By PROF. C. B. COCHRAN, *Chemist of the Department, West Chester, Pennsylvania.*

Some years ago analyses of 250 samples of candy were made under the direction of H. W. Wiley, Chief Chemist of the U. S. Department of Agriculture. The results of these analyses with full details of methods employed in the work, and other particulars relating to the subject were published in Part 6, Bulletin No. 13, in the year 1892. The conclusion of this report is as follows:

GENERAL SUMMARY.

Total number of samples examined,	250
Cantained glucose,	172
Contained starch and gum,	72
Contained organic colors,	218
Contained mineral colors,	2
Contained grease,	14
Contained copper,	4
Contained gelatin,	2

In so far as the coloring matter was examined, the following table shows the character of the pigments used and the relative number of times they respectively were found:

Cochineal,	14	Ultramarine,	3	Lampblack,	1
Eosin,	12	Turmeric,	2	Victoria yellow,	1
Corallin,	6	Methyl orange,	2	Magenta,	1
Bengal red,	5	Coal tar colors,	2	Orange red,	1
Fluorescime,	3	Carmine,	2	Aniline brown,	1
Fluorescent color,	3	Cyanin,	1	Bismarck brown,	1

In connection with the coloring matter, however, it should be remembered that in the great majority of cases no attempt was made to distinguish them further than to determine whether they were of an organic or inorganic nature. Only one analyst, Weber, determined the nature of the coloring matter in each instance. Two of the number, Stubbs and Wallace, did not report the number of samples colored.

On examining the above list it will be noticed that in 56 cases the name of the coloring matter is given. Furthermore we learn that in 2 cases a coal tar color was detected, and in 3 instances some fluorescent color, but the names are not given. The work of analyzing these 250 samples was divided among 10 chemists, each of whom made twenty-five analyses. As these chemists were widely separated from one another and chose their samples from their home markets, the result of their analyses show the composition of confections from various parts of the United States. Regions as widely separated as California, Louisiana, Nebraska and Massachusetts are represented in this report.

The general summary of the work of these chemists is sufficient to show that the coal tar colors are very extensively employed for coloring confections. All but four of the eighteen coloring matters given in the above list are properly classed as coal tar colors.

My own work although confined to the examination of 21 samples shows that the coal tar colors are used just as freely at the present time as they were five years ago. The following table shows the results of the analyses made by my assistant Mr. C. S. Brinton and myself.

Number.	Price.	Direct polarization.	Indirect polarization.	Color of Candy.	Coloring Substance.	Remark.
1	5 cents per package.	....	....	Red, ...	Rhodamine B., ...	Salt water taffy, strawberry flavor.
2	20 cts per lb., ...	....	....	Red, ...	Acid magenta, ...	....
3	20 cts per lb., ...	....	....	Red, ...	Rhodamine B., ...	....
4	....	....	....	Red, ...	Rhodamine B., ...	Stick candy, colored in stripes.
5	60 cts. per lb., ...	....	....	Pale brown, ...	Bismarck brown, ...	....
6	40 cts. per lb., ...	....	....	Green, ...	Indigo carmine, ...	Green peas in pod. The green is a combination of blue and yellow.
7	....	111	+20 at 19 deg. c., ...	Yellow, ...	Auramine, ...	Stick candy colored in stripes.
8	60 cts. per lb., ...	88½	—28 at 20 deg. c., ...	A decided brown, ...	Bismarck brown, ...	....
9	60 cts. per lb., ...	....	....	Violet, ...	Methyl violet, ...	....
10	40 cts. per lb., ...	114	+16½ at 21 deg. c., ...	Red, ...	Rhodamine B., ...	....
11	20 cts. per lb., ...	107	+2 at 22 deg. c., ...	Red, ...	Cochineal, ...	Stick candy.
12	20 cts. per lb., ...	111	+9½ at 21 deg. c., ...	Red, ...	Cochineal, ...	....
13	35 cts. per lb., ...	110	+57 at 22 deg. c., ...	Red, ...	Rhodamine B., ...	....
14	20 cts. per lb., ...	100	—9 at 19 deg. c., ...	Green, ...	Unknown, ...	....
15	20 cts. per lb., ...	....	....	Red, ...	Cochineal, ...	....
16	20 cts. per lb., ...	95	+25½ at 21 deg. c., ...	Red, ...	Rhodamine B., ...	....
17	20 cts. per lb., ...	....	....	Yellow, ...	Fluorescein, ...	....
18	20 cts. per lb., ...	....	....	Brown, ...	Cocoanut, ...	Colored with brown layer on outer part of meat of cocoanut.
19	15 cts. per lb., ...	....	....	Red, ...	Rhodamine B., ...	Made to represent red apples.
20	15 cts. per lb., ...	....	....	Yellow, ...	Fast yellow, ...	Made to represent yellow apples.
21	15 cts. per lb., ...	....	....	Green, ...	Coal tar color, ...	Made to represent green apples.

Sixteen of the 21 samples of candy examined were colored with coal tar colors. Sample No. 6, a green candy made to represent pods of green peas, contained a blue coal tar color, indigo carmine, and a yellow coloring material, the character of which I was unable to determine. It will be noticed that Rhodamine B was found in seven of the twenty-one samples examined by us, while this pigment is not reported at all as occurring in the candies examined by the chemical division of the U. S. Department of Agriculture. On the other hand, Bengal red, a somewhat similar coal tar pigment occurs five times in the report of the Department of Agriculture, but does not appear in our list. It may be that Rhodamine B is supplanting the use of Bengal red, particularly in this section of the country.

The report of Bulletin No. 13 shows about 70 per cent. of confections to be colored with coal tar dyes. Of the 21 samples examined by us, 80 per cent contained coal tar colors.

In addition to the sucrose which was present in all the candies examined, nearly all contained glucose and many also starch and dextrin. No evidence was found of any excess of mineral matter or any injurious substance, unless perhaps the coal tar colors should be so considered. The 21 samples examined by us were obtained in Philadelphia, Reading and West Chester.

In this connection a few words of explanation in regard to the manufacture of the coal tar colors may be of interest.

In Wagner's Hand Book of Chemical Technology, the coal tar colors are classified as follows: 1. Analine colors; 2. Carbolic acid colors; 3. Naphthaline colors, and 4. Anthracene colors. While this classification does not include all coal tar colors, it has the advantage of simplicity and is sufficient for popular purposes. Among the many substances obtained from coal tar are benzene, the starting point of the analine colors; carbolic acid, the starting point of the carbolic acid colors; naphthaline, from which the naphthaline colors are obtained, and anthracene, the basis of the anthracene colors.

One of the most important of the analine colors is fuchsin, known also as magenta, and aniline red. The various steps in the preparation of this dye are briefly described as follows: By the distillation of coal tar is obtained a small amount of a liquid called benzene. By the action of nitric acid on benzene is obtained a liquid called nitrobenzene. If iron filings and acetic acid be added to nitrobenzene, and the mixture subjected to distillation, analine oil will be produced. From this last named substance the analine colors are manufactured. Fuchsin can be made by heating analine oil with nitric acid. Crude fuchsin has a greenish black color and appears to the eye somewhat like bituminous coal. It is often seen in pieces of considerable size.

Some study has been devoted by different investigators to the physiological action of the coal tar colors for the purpose of determining

whether or not their use for coloring foods is objectionable. In most countries coloring of food with substances injurious to health is forbidden by law. In some cases the laws relating to adulteration of food, name the colors that are allowable and those that are forbidden. Among the coloring substances forbidden by the laws of France, is quite a long list of coal tar colors, many of which are now used quite extensively in this country for coloring foods. As example of this may be cited, magenta, methyl orange, eosin, fast yellow.

The Austrian government positively prohibits the use of all coal tar colors for coloring substances included in the list of foods.

The term food in its legal sense includes confections and condiments of every kind.

Professor Weyl has made experiments on dogs with 31 coal tar colors. As a result of these experiments he concludes that 6 of this list of 31 are poisonous and 3 suspicious; the remaining 22 are non-poisonous, at least to dogs. The 6 poisonous colors are naphthol green B, picric acid, saffron substitute, Martiu's yellow, orange II and metanil yellow. The colors named as suspicious are aurantia, soudan I and chrysoidin. Several of the pigments passed by Prof. Weyl as non-poisonous are capable of producing very unpleasant effects, as will be seen from the following statements taken from Weyl's work on the Sanitary Relation of the Coal Tar Colors; translated by Dr. Henry Leffmann:

"Of the 23 azo colors subjected to examination only 2, metanil yellow and orange II, produce such effects when administered by the stomach that we can consider them poisonous. With dogs the lethal dose is less than one gram per kilo of body weight of orange II, and only .53 gram per kilo of metanil yellow. Of the remaining colors some produce vomiting (e. g., Bismark brown), and others diarrhae (fast brown, chrysamin R), and many develop slight albuminuria."

Weyl's entire list contains only one coloring substance (viz: Bismark brown), which I have found in candy. Martiu's yellow (a poisonous pigment), however, has been found by me in two samples of mustard and soudan I (a suspicious pigment), in butter color.

Prof. H. A. Weber, of Ohio, has made a series of experiments with four coal tar colors for the purpose of learning their influence upon digestion. The following is a brief summary of his results.

Exp.	Color used.	Inference from result of Exp.
1	Fast yellow,	Digestion in stomach retarded.
2	Acridine red,	Does not interfere with digestion in stomach.
3	Magenta,	Does not interfere with digestion in stomach.
4	Methyl orange,	Does not interfere with digestion in stomach.
5	Fast yellow,	Does not interfere with intestinal digestion.
6	Acridine red,	Intestinal digestion very much retarded.
7	Magenta,	Intestinal digestion very much retarded.
8	Methyl orange,	Intestinal digestion very much retarded.

Concluding his report, Prof. Weber says:

"It seems then so far as these four colors are concerned that none interfere with both peptic and pancreatic digestion, but that each color interferes seriously with either the one or the other. What the action of other coal tar colors may be, can, of course not be inferred from this limited number of experiments, but it may be safely said that bodies which have such a decided action in retarding the most important functions of the animal economy can not properly have a place in our daily food and drink."

Experiments in artificial digestion were made by Mr. Brinton and myself with seven of the coal tar colors. The material to be digested was powdered beef, previously dried and the fat extracted with petrolic ether. The fluid for peptic digestion consisted of 100 c.c. of a 2-10 of 1 per cent. solution of hydrochloric acid, containing .020 grams of pepsin. The table shows the results of these experiments.

Color Used.	Amount of color taken.	Amount of digesting fluid.	Time of digestion.	Amount of beef taken.	Amount of beef dissolved.
None,	None,	100 c. c.	3½ hours,	1 gram,	0.949 gram.
Auramine,	0.125 grams,	100 c. c.	3½ hours,	1 gram,	0.879 gram.
Bismarck brown,	0.125 grams,	100 c. c.	3½ hours,	1 gram,	0.921 gram.
None,	None,	100 c. c.	3½ hours,	1 gram,	0.952 gram.
Rhodamine,	0.125 grams,	100 c. c.	3½ hours,	1 gram,	0.895 gram.
Rose bengul,	0.125 grams,	100 c. c.	3½ hours,	1 gram,	0.839 gram.
Eosin,	0.125 grams,	100 c. c.	3½ hours,	1 gram,	0.735 gram.
Acid magenta,	0.125 grams,	100 c. c.	3½ hours,	1 gram,	0.415 gram.
Methyl violet,	0.125 grams,	100 c. c.	3½ hours,	1 gram,	0.888 gram.

The effect of three of these colors on pancreatic digestion is shown in the following table:

Color Used.	Amount of color.	Amount of digesting fluid.	Time of digestion.	Amount of beef taken.	Amount of beef dissolved.
None,	None,	100 c. c.	9 hours,	1 gram,	0.949 grams.
Rhodamine,	0.125,	100 c. c.	9 hours,	1 gram,	0.841 grams.
Methyl violet,	0.125,	100 c. c.	9 hours,	1 gram,	0.490 grams.
Eosin,	0.125,	100 c. c.	9 hours,	1 gram,	0.857 grams.

The pancreatic fluid used in these experiments was made as follows: Water, 100 c.c.; sodic bicarbonate pancreatin.

It will be observed that in every case the presence of a coal tar color exerted some retarding influence on digestion. The results indicate that eosin and acid magenta interfere decidedly with peptic digestion, and that methyl violet produces just as decided interference with pancreatic digestion.

While it is true that the amount of coloring matter used in each of these experiments is greater than would be obtained at any one time in eating confections, it is also true the amount of digesting fluid taken is also much larger in proportion to the amount of material to be digested than would be found at one time in stomach or intestines. In these experiments the coloring matter was present in the proportion of 1 part to 800 of digesting fluid. Expressed in the English system of units, the amount of color taken for each test was a little less than 2 grains, and the amount of digesting fluid was about 3½ fluid ounces.

While it is true that experiments in artificial digestion do not show exactly what takes place in the human stomach or intestines, the testimony obtained by such experiments is nevertheless of undoubted value. It therefore seems to me safe to assert that any substance so totally foreign to food as a coal tar dye, which can be shown, when used in reasonable amounts, to retard artificial digestion, must rest under grave suspicion.

Previous experiments made by me seem to indicate that some of the coal tar colors used in colorng food are capable of producing very unpleasant, if not serious symptoms when taken in doses of about 0.125 grams. Whether they are capable of an chronic disturbance when taken daily in minute quantities for a long period of time is as yet an unsettled question.

If the public were fully aware of the character of the pigments used in coloring confections, the sale of these goods when highly colored would probably be considerably decreased.

FOOD PRESERVATIVES.

By Henry Leffmann, A. M., M. D., *Member of the Society of Public Analysts, Philadelphia, Penna.*

The preservation of food articles is one of the most important questions in dietetics. The advances that have been made in this respect of late years, have added greatly, not only to the enjoyment, but to the health of civilized humanity. If man is not properly an omniverous animal in the widest sense of the word, there is little doubt that good health and proper enjoyment of life is materially advanced by an opportunity to select from a large list of food articles. By the very conditions of the problem, the most easily assimilable food will be usually the most readily subject to decomposition, for processes of

digestion are closely allied to processes of putrefaction, particularly as both are more or less dependent upon the so-called hydrolytic actions.

The benefits accruing from the preservation of food have been in no way better shown than in the improvement in the health of sailors While it is true that nowadays ships make only short voyages in the same traffic that in the last century required a longer time, we still find examples of crews that are at sea for six months and over, without opportunity to obtain fresh food of a perishable character. Scurvy, which was so rife among sailors in the days of Drake and Raleigh, is now almost unknown, and in several years experience as a quarantine officer of the port of Philadelphia, I have seen only a few slight cases, and these were upon a vessel that had been over half a year at sea, and had probably been insufficiently provisioned.

By means of preservatives, all foods, with few exceptions, can be made available at all seasons of the year. The diet can, in this way. be given great variety, the monotony of a particular season can be broken up and food adapted to special conditions of temperament or disease be made available. The preservation of food is now carried on on such a large scale that it becomes a prominent question in hygiene and it is worth while to inquire into the methods employed and the effects upon the digestibility and assimilability of the food. It will be well to review briefly the standard methods for food preservation and the principles of their action. All, or at least nearly all the decompositions to which food is subject are due to the growth of micro-organisms. This is a trite observation. Indeed, the action of bacteria is so well-known and occupied such a prominent place in literature that we are apt to overlook the fact that they are not the sole cause of the decomposition of organic matter and that direct oxidations may take place, and also transformation under the influence of non-organized substances. However, the action of microbes is so widely extended, that the principal efforts in food preservation have been directed to securing methods which will either kill the microbes or temporarily suspend their activity. Long continued suspension of vital activity will result in death, hence the latter class of methods is a sort of slow means of carrying out the first class.

Cold.—The preservative action of low temperatures has been known from an early period of the race and has been very widely utilized. In ruder times the best results from it could only be obtained at certain seasons or at certain places, but even savage races are well aware of the action of low temperatures in restraining decomposition. At the present day, the employment of cold-storage has given us excellent means of preservation, but they are of comparatively restricted application and particularly serviceable as the name indicates for the storage of large quantities of perishable materials convenient to the markets. Their employment, on the small scale, involves consider-

able expense and is applicable only where some degree of luxury exists. The great mass of the community requiring that the cost of living shall be reduced to a minimum, cannot avail itself of such methods. Even the ordinary house-refrigerator is but a temporary expedient. Cold acts by inhibiting or restraining the development of micro-organisms and thereby checking their chemical activity. Experiment shows that many common microbes will live for months in ice, though as remarked above, this cannot continue indefinitely; ultimately, anything kept below the freezing point will become sterile.

Heat.—A temperature of 212 degrees F., maintained for a few minutes, is fatal to almost all living structures. A few microbes will bear a higher point, many succumb at much lower temperatures. Observations recently made show that if milk be maintained at 160 degrees F. for twenty minutes, about one in every 4,000 of the original micro-organisms will be left alive. Evidently we have, in the action of heat, a safe, quick and efficient method of preservation, but the articles must be kept from re-contamination if we desire to avail ourselves of the method practically. A momentary exposure to the air will be sufficient to inoculate the mass with putrefactive organisms; hence, in the practical application of the heat methods, the manufacturer resorts to hermetically sealing, and it is well known that the article thus prepared soon becomes changed when the can is opened.

Neither of the methods of heat or cold meet all the practical requirements. With a very large number of food articles, especially vegetables, some method is needed which will permit the article to be sold in the uncooked condition and in packages that may be kept open for some time. At the present time these requirements are mostly met by the introduction of substances antagonistic to microbes. In food articles, it is, of course, not permissible to use the active germicides, such as corrosive sublimate or zinc chlorid, since these are very poisonous; the articles used belong to the class of antiseptics. They restrain the development of microbes, but in general do not kill them. Some of these agents have been in use from an early period and are still largely employed. Common salt, wood smoke, vinegar, saltpetre and sugar are well known substances of this type. They are generally considered not unwholesome, but our views in this respect are traditional and conventional rather than scientific.

It is, indeed, shown by the earlier experiences to which reference is made above, that the constant use of salted food, to the exclusion of fresh articles, results in very serious disorders of nutrition.

For many articles, the taste of these preservatives renders them unavailable, for some articles they are useless while others are so much changed as to render them unfit for use. The specific food preservatives now in use are mostly organic bodies, obtained artificially from coal tar, that seemingly inexhaustible mine of useful articles. Some of these preservatives are obtainable from natural sources, but at such

considerable expense as to take this method of preparation out of consideration in the practical aspect. Two commonly used preservatives, boric acid and borax, are mineral substances. A brief account of the character and composition of the preservatives will be opportune.

SALICYLIC ACID.

This substance may be obtained from oil of wintergreen and also from salicin, the bitter principle of the willow leaf. These methods are too costly for the production of it as a food preservative, for which purpose it is obtained by a process discovered by Kolbe, the action of carbon dioxid upon sodium phenate. This simple and inexpensive synthetic method gave great impetus to the use of this article as a preservative, and for many years it was extensively employed. Chemically, it is orthocarboxyhydroxybenzene, C^6H^5 (COOH) (OH). It is one of three isomeric forms, and according to a few experiments recently made by me, is the most active of the three. In its commercial form, it is a loose, colorless crystalline powder, sparingly soluble in cold water and readily soluble in alcohol. It has decided antiseptic qualities, solutions as weak as one-ten thousandth, exhibiting this property. As a preservative, it is employed in quantities varying from about one to six hundred in catsup to about one in five thousand in jellies and jams. While salicylic acid obtained from natural sources is pure, the artificial acid is liable to be contaminated with by-products more poisonous than salicylic acid itself, and this fact must always be taken into consideration when judging of the sanitary relations of the substance. Since the natural acid sells at over ten times the cost of the artificial, it is not likely that the former will be used on the large scale. Salicylic acid is often sold under the name of "extract of salix," and under proprietary titles, such as "preservaline," for the preservation of milk, cider and similar products.

SODIUM BENZOATE.

Benzoic acid exists in the gum benzoin, but the commercial article is now largely obtained from toluene, a hydrocarbon existing in coal tar. It has long been used to prevent rancidity in medicinal ointments but is not used as a food preservative, probably on account of its strong odor and slight solubility in water. Sodium benzoate, which is nearly colorless and freely soluble, is largely employed and is apparently steadily displacing salicylic acid. Most of the sodium benzoate used is doubtless made from the artificial acid, but there is much less objection to this than in the case of salicylic acid. Commercial sodium benzoate is usually a coarse white powder with little odor. It is freely soluble in water.

BORIC ACID AND BORAX.

These are well known mineral substances. Borax is usually regarded as the sodium salt of boric acid; this is not in accordance with the views of many chemists, but the question is not important. The acid properties of boric acid are feeble and need not be taken into consideration in discussing its sanitary relations. It is a white crystalline powder, soluble in water and alcohol. Borax is also a white crystalline substance, soluble in water; the solution has a distinct alkaline reaction. Boric acid and borax, both alone and in mixture, have been largely used as food preservatives, especially for meat, milk and milk products. For milk, it appears that the mixture of the two is better than either alone. Boric acid and borax are mineral substances liable to little change or alteration in the system, a fact which bears upon their suitability for use in food. Various preparations of boric acid or borax, and glycerol are now used as preservatives under the names of boroglycide or by proprietary names.

FORMALDEHYDE.

This is one of the newest preservatives and gives promise of being the preferred one. It is a gas at ordinary temperatures, but is readily soluble in water; a 40 per cent. solution is commercially known as formalin. Formaldehyde has a decidedly germicide action and in addition possesses the power of rendering nitrogenous matters insoluble and more or less indigestible. It is now largely used for preserving milk, in which it produces several marked changes as will be noted later.

BETA-NAPHTHOL.

This is one of two isomeric coal tar products. It has decided antiseptic qualities, but is little used as a food preservative and need not be especially considered.

FLUORIDS AND SILICOFLUORIDS.

Sodium fluorid and sodium silicofluorid have been somewhat used as preservatives, especially in malt liquors. They are white powders, soluble in water.

EFFECTS OF FOOD PRESERVATIVES.

The effects of food-preservatives upon the human system may be considered in two phases: First, Is any direct injury to health caused by the constant ingestion of minute amounts in admixture with ordinary food. Second, Are the processes of digestion and nutrition deranged by the agent, so that injury to health indirectly results. To decide the former question, we have practically no information except that depending on experiments on the lower animals and it will

be unsafe to accept this as a positive guide. Most food-preservatives are poisonous in large doses, but it would be a most serious error to declare that a substance which can do much harm in doses of half ounce will do some harm in doses of one-tenth grain, frequently repeated. Such a line of argument would compel us to regard vinegar, salt, vanilla, coffee, tea and many other articles as unwholesome.

The second phase of the question is the one to which this report principally relates. An effort has been made to find out how far the different food-preservatives interefere with digestive action. The results must be regarded as suggestive only; the field is so extensive and so beset with obstacles that many of the results must be received with caution, but an endeavor has been made to carry out the experiments so as to permit comparisons to be made, that is, to eliminate many of the errors by equalizing them in all of the experiments.

The method of experimentation has been to test the action of solutions of the various digestive agents in the presence of known amounts of preservatives and also, of course, as control experiments, at the same time and under the same conditions, the action of the ferment without any preservative. The investigation has been extended to digestive agents which are vegetable in origin and which do not occur in the human body, although closely analagous substances do occur.

Digestive ferments, known technically as "enzyms," are nitrogenous substances very similar to proteids, which have the power to cause certain organic bodies to take up water and form new substances that are more soluble in water and more diffusible through membranes.

As a rule, the enzyms are sensitive to mineral substances, but pepsin is an exception. Its full action is shown only in admixture with a notable amount of hydrochloric acid. Enzyms bear a rather high degree of dry heat, but in a moist heat are rendered inactive at a temperature of 212 degrees F., and probably below that. They retain their power for a long while when kept dry and are capable of transforming many times their weight of other bodies without becoming inactive.

Chemists have endeavored to use a definite system of nomenclature for these substances, giving them the termination "ase," but this rule is unfortunately not followed in the names of the most familiar enzyms, such as pepsin, ptyalin and trypsin.

EXPERIMENTS ON STARCH DIGESTION.

Arrow-root was used in each case unless otherwise noted. The solution was prepared by mixing the weighed quantity of starch with a small amount of cold water and stirring this into a much larger amount of boiling water. When a uniform mass was obtained, the

liquid was cooled and made up to a definite volume. In some of the earlier experiments the proportion was twenty grams of starch to one liter, but later half this quantity was used.

The first series of experiments was qualitative only; that is, the amount of sugar or dextrin formed was not determined, but merely the presence or absence of starch and whether the dextrin was in its fully developed condition or only in the initial stages. These facts are determined by a solution of iodin and potassium iodid in water. This produces a red color with the dextrins first formed (erythrodextrin), a pale yellow with the fully formed dextrin, a deep blue with appreciable amounts of starch and a greenish tint with very small amounts of starch. These tests are preliminary only. Much more information is obtained by determining the amount of sugar formed and this was done in a number of cases, as will be noted. Many experiments that are in the laboratory record are not reported, being merely duplicates or vitiated by some accidental error. All weights are in milligrams. Short tests (e. g., one hour) were made at about blood heat; when the liquids were allowed to stand over night, it was at room temperature. The commercial form of the antiseptic was used unless otherwise specified. The enzyms were all in good condition. The following is a description of the enzyms used:

(1.) Malt diastase.—An active form obtained from Merck & Co.

(2.) Taka-diastase.—The recently introduced enzym; the most active starch-transforming agent known. It was used both in the powdered form and in active solution. Both preparations were from Parke, Davis & Co.

(3.) Pancreatic extract.—A solution prepared by Parke, Davis & Co.

(3.) Peptenzym.—A preparation in form of powder, made by Read & Carnrick, and containing all the digestive enzyms of the alimentary tract.

(3.) Carase.—The enzym of the papaw; the preparation used was that sold under the trade name "caroid."

Some experiments were made with the pine apple ferment and also with pepsin, but the results are not worth reporting.

Starch solution, 10 grams 1 liter 50 cc. taken for each experiment:
Starch solution, 10 grams 1 liter 50 cc. taken for each experiment:
Starch solution, 10 grams 1 liter 50 cc. taken for each experiment:

Antiseptic.		Taka Diastase.	Results.
1. None,		11	Starch all converted.
2. Saccharin,	10	11	Some starch present.
3. Saccharin,	50	11	Much starch present.
4. Saccharin,	100	11	Much starch present.
		Carase.	
5. None,		20	Starch all converted.
6. Saccharin,	10	20	Much starch present.
7. Saccharin,	50	20	Much starch present.
8. Saccharin,	100	20	Much starch present.

Antiseptic.		Peptenzyme.	Results.
9. None,		20	Starch all converted.
10. Saccharin,	10	20	Some starch present.
11. Saccharin,	50	20	Much starch present.
12. Saccharin,	100	20	Much starch present.
13. Beta-naphthol,	10	20	Starch all converted.
14. Beta-naphthol,	50	20	Starch all converted.
15. Beta-naphthol,	100	20	Starch all converted.
		Taka Diastase.	
16. Beta-naphthol,	10	11	Starch all converted.
17. Beta-naphthol,	50	11	Starch all converted.
18. Beta-naphthol,	100	11	Starch all converted.
19. Formalin,	3 cc.	11	Starch all converted.
		Pancreatic Solution.	
21. Formalin,	1 cc.	1 cc.	Much starch present.
22. Formalin,	3 cc.	1 cc.	Much starch present.
		Taka Diastase.	
23. None,		10	Starch all converted.
24. Artificial benzoic acid,	100	10	Faint trace of starch.
25. Artificial benzoic acid,	50	10	Starch all converted.
26. Artificial benzoic acid,	50	10	Starch all converted.
27. Artificial benzoic acid,	25	10	Starch all converted.
28. Artificial benzoic acid,	25	10	Starch all converted.
29. Natural benzoic acid,	100	10	Starch all converted.
30. Natural benzoic acid,	50	10	Starch all converted.
31. Natural benzoic acid,	50	10	Starch all converted.
32. Natural benzoic acid,	25	10	Starch all converted.
33. Natural benzoic acid,	25	10	Starch all converted.
34. Artificial sodium benzoate,	100	11	Starch all converted.
35. Artificial sodium benzoate,	50	11	Starch all converted.
36. Artificial sodium benzoate,	50	11	Starch all converted.
37. Artificial sodium benzoate,	25	11	Starch all converted.
38. Artificial sodium benzoate,	25	11	Starch all converted.
		Malt Diastase.	
39. Benzoic acid,	100	20	Much starch present.
40. Benzoic acid,	50	20	Starch all converted.
41. Benzoic acid,	10	20	Starch all converted.
42. Sodium benzoate,	100	20	Starch all converted.
43. Sodium benzoate,	50	20	Starch all converted.
44. Sodium benzoate,	10	20	Starch all converted.
45. Boroglycide,	3 cc.	20	Starch all converted.
46. Boroglycide,	1 cc.	20	Starch all converted.
		Pancreatic Solution.	
47. None,		3 cc.	Starch all converted.
48. Salicylic acid,	100	3 cc.	Much starch present.
49. Salicylic acid,	50	3 cc.	Much starch present.
50. Salicylic acid,	10	3 cc.	Some starch present.
51. Benzoic acid,	100	3 cc.	Much starch present.
52. Benzoic acid,	50	3 cc.	Much starch present.
53. Benzoic acid,	10	3 cc.	Starch all converted.
54. Sodium benzoate,	100	3 cc.	Starch all converted.
55. Sodium benzoate,	50	3 cc.	Starch all converted.
56. Sodium benzoate,	10	3 cc.	Starch all converted.
57. Sodium carbonate,		3 cc.	Much starch present.
58. Citric acid,		3 cc.	Much starch present.
		Carase.	
59. Salicylic acid,	100	30	Much starch present.
60. Salicylic acid,	50	30	Much starch present.
61. Salicylic acid,	10	30	Much starch present.
62. Benzoic acid,	100	30	Starch all converted.
63. Benzoic acid,	50	30	Starch all converted.
64. Benzoic acid,	10	30	Starch all converted.
65. Sodium benzoate,	100	30	Starch all converted.
66. Sodium benzoate,	50	30	Starch all converted.
67. Sodium benzoate,	10	30	Starch all converted.
68. Boroglycide,	0.5 cc.	30	Much starch present.

Antiseptic.		Taka Diastase.	Results.
69. Boric acid,	200	11	Starch all converted.
70. Boric acid,	100	11	Starch all converted.
71. Boric acid,	100	11	Starch all converted.
72. Boric acid,	50	11	Starch all converted.
73. Boric acid,	50	11	Starch all converted.
74. Borax,	200	11	Starch present.
75. Borax,	100	11	Trace of starch present.
76. Borax,	100	11	Trace of starch present.
77. Borax,	50	11	Trace of starch present.
78. Borax,	50	11	Trace of starch present.
79. Boroglycide (several drops),		11	Starch all converted.
80. Boroglycide,	1 cc.	11	Starch all converted.
81. Boroglycide,	3 cc.	11	Starch all converted.
82. Tartaric acid,	100	11	Much starch present.
83. Tartaric acid,	25	11	Some starch present.
84. Citric acid,	100	11	Much starch present.
85. Citric acid,	25	11	Starch all converted.
86. Borax,	50	Malt diastase,	Much starch remaining.
87. Borax, 88. Boric acid,	25 25	Malt diastase,	Much starch remaining.
89. Borax, Boric acid,	50 50	Malt diastase,	Much starch remaining.
90. Borax, Boric acid,	25 25	Taka diastasa,	Starch all converted.
91. Borax, Boric acid,	25 25	Pancreatic,	Starch all converted.
92. Boric acid, Borax,	50 50	Pancreatic,	Starch all converted.
93. None,		Peptenzyme,	Trace of starch present.
94. Boric acid, Borax,	25 25	Peptenzyme,	Much starch present.
95. Boric acid, Borax,	50 50	Peptenzyme,	Much starch present.
		Peptenzyme.	
96. Boric acid,	100	20	Starch still present.
97. Boric acid,	20	20	Starch still present.
98. Borax,	100	20	Starch still present.
99. Borax,	20	20	Starch still present.
100. Boric acid, borax,	20	20	Starch still present.
101. Boric acid,	100	Pancreatic solution. 1 cc.	Very faint trace of starch.
102. Boric acid,	20	Pancreatic solution. 1 cc.	None.
103. Borax,	100	Pancreatic solution. 1 cc.	None.
104. Borax,	20	Pancreatic solution. 1 cc.	None.
105. Boric acid, borax,	20	Pancreatic solution. 1 cc.	Very faint trace of starch.
106. None,		Pancreatic solution. 1 cc.	Starch all converted.
		Carase.	
107. Boric acid,	150	20	Starch present.
108. Boric acid,	100	20	Starch present.
109. Boric acid,	50	20	Starch converted.
110. Boric acid,	10	20	Starch converted.
111. Borax,	150	20	Starch present.
112. Borax,	100	20	Starch present.
113. Borax,	50	20	Starch present.
114. Borax,	10	20	Starch present.
115. Boric acid and borax (each),	50	20	Starch present.
116. Boric acid and borax (each),	25	20	Starch present.
117. Boric acid and borax (each),	10	20	Starch all converted.
118. None,		20	Starch all converted.
119. Sodium fluorid,	10	20	Much starch present.
120. Sodium fluorid,	50	20	Much starch present.
121. Sodium fluorid,	100	20	Much starch present.
122. Sodium silicofluorid,	10	20	Trace of starch present.
123. Sodium silicofluorid,	50	20	Much starch present.
124. Sodium silicofluorid,	100	20	Much starch present.

Antiseptic.		Malt Diastase.	Results.
125. Sodium fluorid,	10	20	Starch all converted.
126. Sodium fluorid,	50	20	Starch all converted.
127. Sodium fluorid,	100	20	Starch all converted.
128. Sodium silicofluorid,,	10	20	Starch all converted.
129. Sodium silicofluorid,	50	20	Starch all converted.
130. Sodium silicofluorid,	100	20	Starch all converted.
		Taka Diastase.	
131. Sodium fluorid,	10	11	Starch all converted.
132. Sodium fluorid,	25	11	Starch all converted.
133. Sodium silicofluorid,	10	11	Starch all converted.
134. Sodium silicofluorid,	25	11	Starch all converted.
		Pancreatic Solution.	
135. Sodium fluorid,	10	1 cc.	Solution rendered perfectly clear, but starch not converted.
136. Sodium fluorid,	25	1 cc.	Solution rendered perfectly clear, but starch not converted.
137. Sodium silicofluorid,	10	1 cc.	Starch solution remains cloudy.
138. Sodium silicofluorid,	25	1 cc.	Starch solution remains cloudy.

EXPERIMENTS TO DETERMINE AMOUNT OF SUGAR FORMED.

Starch solution, 10 grams to 1 liter, 50 cc. used in each experiment, all solutions diluted to 150 after digestion.

1. Salicylic acid,	50 Taka diastase,	11
2. Sodium benzoate,	50 Taka diastase,	11
3. Saccharin,	50 Taka diastase,	11
4. Boric acid,	50 Taka diastase,	11
5. No antiseptic,	50 Taka diastase,	11

1. Shows starch reaction strongly and only traces of sugar; 133 cc. of the solution does not reduce 10 cc. of copper solution equivalent to 0.046 dextrose.

2. No starch present; much sugar formed.

3. Much starch present; traces of sugar.

4. No starch present; much sugar formed.

5. No starch present; much sugar formed.

6. Salicylic acid,	50 Pancreatic solution 1 cc.,	No sugar formed.
7. Sodium benzoate,	50 Pancreatic solution 1 cc.,	Much sugar formed.
8. Saccharin,	50 Pancreatic solution 1 cc.,	No sugar formed.
9. Boric acid,	50 Pancreatic solution 1 cc.,	Much sugar formed.
10. None,	Pancreatic solution 1 cc.,	Much sugar formed.

Measured by Fehling's solution volumetrically, Nos. 7, 9 and 10 showed the same amount of sugar.

11. Salicylic acid,	50 Pancreatic solution 3 cc.,	No sugar formed.
12. Sodium benzoate,	50 Pancreatic solution 3 cc.,	Much sugar formed.
13. Saccharin,	50 Pancreatic solution 3 cc.,	Trace of sugar formed.
14. Boric acid,	50 Pancreatic solution 3 cc.,	Much sugar formed.
15. None,	Pancreatic solution 3 cc.,	Much sugar formed.

Tested by Fehling's solution, Nos. 12, 14 and 15 showed the same quantities of sugar; no starch was present. Starch was abundantly present in Nos. 11 and 13; in the latter it was well liquified but not in the former.

The following experiments are quoted from a paper published some

years ago by Dr. Beam and myself. A portion of this paper was published in The Analyst, but the complete paper was privately printed as a pamphlet.

Starch solution, 20 grams to 1 liter.

Malt diastase, 1 part to 500 of liquor.

Antiseptic.		Result.
16. None,	....	Much sugar formed.
17. Salicylic acid,	1 to 3,000	Less sugar formed than in experiment 16.
18. Salicylic acid,	1 to 1,500	Very little sugar formed.
19. Salicylic acid,	1 to 1,000	No sugar formed.

Same starch solution, but 1 part of diastase to 1,000 of liquid:

Antiseptic.		Result.
20. None,	....	Much sugar formed.
21. Salicylic acid,	1 to 1,000	No sugar formed.
22. Boric acid,	1 to 1,000	Much sugar formed.
23. Sodium acid sulfite,	1 to 1,000	Much sugar formed.
24. Saccharin,	1 to 1,000	No sugar formed.
25. Beta-naphthol,	1 to 1,000	Much sugar formed.
26. Alcohol,	1 to 25	Much sugar formed.

One part of diastase to 2,000 of liquid:

Antiseptic.		Result.
27. None,	....	Much sugar formed.
28. Salicylic acid,	1 to 5,000	Little sugar formed.
29. Salicylic acid,	1 to 3,000	No sugar formed.

Experiments with pancreatic extract (Fairchild's):

Antiseptic.		Result.
30. None,	....	Much sugar formed.
31. Salicylic acid,	1 to 1,000	No sugar formed.
32. Saccharin,	1 to 1,000	No sugar formed.
33. Beta-naphthol,	1 to 1,000	Much sugar formed.
34. Boric acid,	1 to 1,000	Much sugar formed.
35. Sodium acid sulfite,	1 to 1,000	Much sugar formed.

The amounts of sugar found in experiments 30, 33 and 34 were the same; in experiment 35, a trifle more.

EXPERIMENTS UPON DIGESTION OF PROTEIDS.

The information on this phase of the question is still very incomplete. The products of proteid digestion are much more complex than those of starch digestion, and the detection and estimation of the different substances are much more difficult. The action of pepsin is peculiar in that it requires a distinct amount of acid. Pancreatic digestion, on the other hand, is promoted by alkalies and is restrained by acids. It is not opportune to discuss physologic questions here, but it may be said that the action of pepsin is comparatively limited. Chittenden found that even after two weeks continuous action of a mixture of hydrochloric acid and pepsin made in close imitation of human gastric juice, only a little more than half of the proteid was converted in peptone; that is, had been fully digested.

The few qualitive experiments that I have made are summed up in the statements of general conclusions below.

In The Analyst, for July, 1897, appears a paper by Mr. R. A. Cripps, detailing an investigation made to determine the action of boric acid on transformations of starch by malt-diastase and saliva, on coagulated albumin by pepsin and pancreatic and milk proteids by rennet. Even when considerable amounts of boric acid were used, no interference was noted, except that 1 per cent. of boric acid delayed considerably the digestion by the pancreatic solutions. The experiments were mostly qualitive. In the discussion that followed the reading of the paper, several chemists referred to other investigations showing similar results.

Laboratory digestion experiments are not exact representations of the natural processes. Many conditions obtain in natural digestion which we can imitate only imperfectly or not at all. There are, for example, the kneading motion, the exact regulation of the temperature and the constant removal of the products of digestion by osmose. It is also probable that the microbes normally present in the stomach and intestine have a considerable to digestion.

It must, however, be said that laboratory experiments do approximate to natural digestions in so far that it will be extremely improbable that an entirely negative result would be obtained in the former and an appreciably positive result in the latter; that is, it is not presumable that an enzym will fail entirely to convert dissolved starch and albumin in the trial-flasks and yet digest the same in the stomach.

The general conclusions that may be drawn are:

Salicyclic acid in all its forms, i. e., natural, crude commercial and refined commercial, are distinctly antagonistic to most enzyms, especially those that convert starch. There seems to be no reason to believe that the natural form of the acid will be less objectionable than the artificial in this respect, even if its price does not exclude its use.

Sodium benzoate is without appreciable interfering action and as its preservative action is undoubted and its disagreeable taste will prevent its liberal use in any food article, it seems to be well adapted for general use.

Boric acid and borax show but little interfering action with either starch or proteid digestion. Boroglycide semms also to possess but little interfering action.

Beta-naphthol interferes with the action of malt-diastase, but not seriously with taka-diastase or pancreatic extract. In interferes very decidedly with peptic and pancreatic digestion of proteids.

Sodium fluorid has but little interfering action with starch transformations, but sodium silicofluorid interferes decidedly with pancreatic extract.

Sodium acid sulfite is without retarding effect.

Salicylic acid does not interfere seriously with proteid digestion.

Concerning the effects produced upon the human system by long continued administration of small doses of common food preservatives, we have, as remarked above, but little information. Some German investigators have studied the action of salicylic acid, in this respect, notably Kolbe, who discovered the synthetic method of preparing it. He found no appreciable injurious effect, but he probably used a purer article than is often found in commerce. Experiments on lower animals are numerous. Among the most recent of these is a contribution by R. A. Chittenden and W. O. Gies, of Yale University (Amer. Jour. of Phys., Vol. I, No. 1), detailing an extended study of boric acid and borax on the nutritive and execretive functions of dogs. All the data are given in the report and great care was taken in the experiments. The conclusions are as follows:

Moderate doses of borax, up to five grams per day, even when continued for some time, are without influence upon proteid metabolism, and do not exert any specific nutritional changes. Under no circumstances, so far as we have been able to ascertain, does borax tend to increase body weight or to protect the proteid matter of the tissues.

Large doses of borax, 5-10 grams daily, have a direct stimulating effect upon proteid metabolism, as claimed by Gruber; such doses, especially if continued, lead to an increased excretion of nitrogen through the urine; also, of sulphates and phosphates.

Boric acid, on the other hand, in doses up to three grams per day, is practically without influence upon proteid metabolism and upon the general nutrition of the body.

Borax, when taken in large doses, tends to retard the assimilation of proteid and fatty foods, increasing notably the weight of the feces and their content of nitrogen and fat. With very large doses there is a tendency toward diarrhoea, an increased excretion of mucous. Boric acid, on the contrary, in doses up to five grams per day, is wholly without influence in these directions.

Borax causes a decrease in the volume of the urine, changes its reaction to alkaline and raises the specific gravity, owing to the rapid elimination of the borax through this channel. Under no circumstances have we observed any diuretic action with either borax or boric acid. The latter agent has little effect on the volume of the urine.

Both borax and boric acid are rapidly eliminated from the body through the urine, twenty-four to thirty-six hours being generally sufficient for their complete removal. Rarely are they found in the feces.

Neither borax nor boric acid have any effect on the putrefactive processes of the intestine as measured by the amount of etheral sulphates in the urine, or by Jaffe's indoxyl test. Even very large doses of borax are inactive in this respect, not because it is without action upon microbes, but because of its rapid absorption from the intestinal tract.

Boric acid and borax, when given in quantities equal to 1.5-2.0 per cent. of the daily food, are liable to produce nausea and vomiting.

Owing to the rapid elimination of both borax and boric acid, no marked cumulative action can result from their daily ingestion in moderate quantities.

At no time in these experiments was there any indication of abnormality in the urine; neither albumin nor sugar was found.

The following table taken from The Analyst, for March, 1896, gives some results obtained by R. T. Thompson, city analyst of Glasgow, Scotland, in studying the action of common preservatives of milk. They are quoted here as being some guide to amounts of preservatives necessary to restrain decomposition. The gallon is the English Imperial gallon. The figures in the last two columns are percentages of lactic acid present. Formalin is a 40 per cent. solution of formaldehyde:

Antiseptic.	Grains Per Gallon.	After Two Days.	After Six Days.	After Eight Days.	After Seventeen Days.
None,	Turned.	Sour,	Sour,	.68	.71
Formalin,	8.75	Sweet,	Sweet,	Sweet, .12	Sour, .42
Formalin,	17.50	Sweet,	Sweet,	Sweet, .10	Sweet, .14
Formalin,	35.00	Sweet,	Sweet,	Sweet, .07	Sweet, .10
Boric acid,	35.00	Sweet,	Turned,	.42	.52
Boric acid and borax,	17.50	Sweet,	Sweet,	Sweet, .10	Sour, .32
Salicylic acid,	17.50	Sweet,	Sweet,	Sour, .26	.42
Salicylic acid,	35.00	Sweet,	Sweet,	Sweet, .10	Sour, .33
Benzoic acid,		Sweet,	Turned,	Sour, .45	.52

Formalin is seen to be the most efficient preservative.

An issue that has been raised incidentally within the past year is, how far the artificial colors that are now so largely used in foods may be unwholesome, directly or indirectly. The researches of Weyl have shown pretty clearly that very few colors are even slightly toxic and that those adapted to food uses are without injurious action. Several observers have studied the influence of coal tar colors on enzyms, but in most cases have used quantities of color much too large. The high coloring power of these bodies permits them to be used in very small porportion, and to operate on quantities of the color which would be sufficient to color the food taken by one person in an entire week is not a proper method.

The present report must be regarded as a preliminary one only. Many more experiments are needed before we can determine the general laws controlling the action of enzyms. For example, researches on enzyms recently published by Stone, have shown that all kinds of starch are not equally susceptible to the action of the same enzym under the same conditions.

THE NECESSITY FOR A BUTTER STANDARD.

By DR. F. A. GENTH, JR., *Chemist of the Department, Philadelphia, Pa,*

Butter is the separated fatty portion of milk, combined with small and varying amounts of casein, water and ash, which latter is mainly composed of salt added during the process of manufacture. By means of violent agitation or churning, the fat globules of the milk or cream are made to coalesce, then separated from the residual butter-milk and well washed with water and salt, whereby the greater amount of caseous matter is removed.

The percentage composition varies considerably according to the milk or cream used and the care taken in its manufacture. Normal cow butter, not melted and not salted, was found by Koenig to contain:

Fat,	87.0 per cent.
Casein,	0.5 per cent.
Milk sugar,	0.3 per cent.
Ash,	0.3 per cent.
Water,	11.7 per cent.

Pure butter fat is a complex compound, consisting chiefly of the glycerides of a series of fatty acids. Some of these, a little over 92 per cent., may be considered as olein, stearin and palmitin, and the rest as butyrin, caproin, caprylin, etc. It is owing to these latter compounds that butter has its peculiar and distinctive character and flavor.

Casein and milk sugar, generally reckoned together as curd, etc., are the extraneous matter derived from milk which has not been completely eliminated by washing. Its presence, with water, is objectionable because it is apt to cause the butter to become rancid. This tendency to rancidity is, to a certain extent, proportionate to the amount of curd present, and the latter should, therefore, be eliminated as much as possible. A small quantity of salt is added during the making of the butter to check this tendency towards putrefaction. In some countries, the butter is melted until it has become fairly clear, and then separated from curd and water, whereby the same object is accomplished, at the expense, however, of a part of the fine flavor of the butter.

The ash consists mostly of lime salts, derived from the milk. Its percentage is small and is, therefore, frequently reckoned with the added salt, which may increase the proportion of ash considerably.

The introduction of salt and water into butter, and also the greater or less care exercised in freeing the fats from curd in the process of butter making are the causes of the large variations in the percentage compositions of different samples of butter. The honest dairyman who endeavors to give full value for the money he receives, by offering the largest possible percentage of properly washed butter fat in his butter, finds that other samples are constantly offered which are loaded more or less with water and salt, the manufacturer trusting to the lack of legislation on the subject and the ignorance of the consumer.

Dairy butter, made with ordinary care, has an average composition of:

Fats, ...	83 to 89 per cent.
Curd, ...	under 2 per cent.
Salt	1 to 3 per cent.
Water, ...	8 to 13 per cent.

According to Dr. Hassall, it should not contain under 80 per cent. fat, 4 per cent. each of salt and curd, excepting in salt butters where the percentage of salt may run up to 8 per cent., and 12 per cent. water. Dr. Blyth places the minimum percentage of fat as 80 per cent., gives no value to water and states thta curd should average about 2½ per cent., but in exceptional cases may run up to 6 or 7 per cent. In Germany, according to Ellsner, a minimum of 85 per cent. of fat is required, and a basis of 90 per cent. taken as the amount of fat for an average butter. In other countries the minimum percentage of fats varies from 80 to 90 per cent.

In our own country but few laws have been enacted setting a definite standard upon the composition of butters. In Oregon a butter must contain less than 14 per cent. of water, and in Ohio a butter having less than 80 per cent. butter fat can b^ brought under the oleo law.

The definitions for pure butter, too, are more or less conflicting; thus, according to the spccial report on the extent of food adulterations, by Alex. J. Wedderburn, its proper proportion of water is placed as from 5 to 10 per cent. In England, 15 per cent. is considered by Allen to be a maximum figure for water.

Battershall, in New York, states that butter should contain 80 per cent. fat at the very least and ought to run from 82 to 90 per cent.

Among the butters in this market there are certain brands that pass under the several names of "boiled," "fused," "renovated" or "process butters." Consumers, mostly of the poorer classes, buy these as creamery butters.

As described to the writer by a representative of one of the largest manufacturers of process butter, it is made as follows: The cheaper

grades of butter, mostly western, which contain large amounts of water and are more or less rancid, are melted in jacketed vessels at the temperature of 98 degrees (ordinary blood heat), care being taken not to let it rise above this point. The curd and water settle to the bottom, and are then drawn off. After removal of the same a current of air is caused to pass through the butter fat, thus aerating it, and after the lapse of some time the current is interrupted, the fat again heated at the temperature of blood heat.

Large quantities of skim-milk are purchased, sterilized and subjected to the action of Prof. Conn's bacterium, B-41. After ripening the milk is brought into a churn with the butter fat as above made, and remade into a butter by churning, etc., as practiced in ordinary butter making. The butter is put up in regular print forms and sold in the stores as creamery butter.

How well the same is cured of any of the so-called diseases of butter, such as off flavor butter, tallowy butter, bitter butter, etc., is a subject for further investigation, particularly by the bacteriologist. It should be borne in mind that the temperature at which the fats have been separated from the stale curd is much below that at which sterilization is generally effected.

Such process butters as have come under the writer's observation have not been found to be of a uniform composition. The samples which were first received contained rather excessive amounts of water from the presence of skim-milk, etc., but the later ones were considerably drier, and ran much higher in their percentages of butter fat.

In order to determine what should be a fair standard of percentages for butters in this State, the writer caused a number of samples to be collected in Philadelphia and vicinity for the purpose of analysis After first identifying the sample as one of butter fat it was examined according to the following method, which is practically the same as that adopted by the Association of Official Agricultural Chemists:

Most of the samples were first taken and submitted to a rough test, such as is used by the agents, to distinguish the same from a fresh dairy butter. A small portion was placed in a vessel and quickly heated. Quiet frothing or foaming is considered to be indicative of unmelted butter in most cases, whilst a decided sputtering of the heated sample would indicate possible oleo, fused butter, etc. This test is by no means infallible, and as said before, merely a rough one. Some few samples were examined under the microscope with the result that all those that showed decided crystalline structure corresponded with the sputtering ones, showing fairly clearly that these samples had been melted and renovated ones. All samples, thus examined, which showed no crystalline structure corresponded to one of the frothing kinds. The microscope, too, is not an infallible detective for boiled or unboiled butters because crystals sometimes appear in old unboiled samples.

A small portion (about $1\frac{1}{2}$ to $2\frac{1}{2}$ grams) of butter was placed into a flat-bottomed vessel and heated over boiling water. In order to facilitate the desiccation of the sample the vessel was frequently agitated. When the last two or three weighings showed constant results, or a slight increase in the weight over the last previous weighing, the difference between the lowest weight and that of the sample was used to determine the percentage of water.

In order to determine the fats, the sample was then brought to the fusing point and 76 degrees benzine added in order to dissolve the fats. The resulting solution was then decanted from the residue, and the latter repeatedly washed with benzine until free from the last traces of fat, then once with ether and after decantation, dried at a low heat reflected into the dish and weighed. The loss in weight represents the amount of butter fat and the residue the curd and salt.

The percentage of curd was then determined by heating the dish at a low heat at first and, after some time, incinerating at a low red heat, and weighing when all carbonaceous matter had been burned off. The loss in weight represented the curd and the weight of the residue was calculated to ash.

In some of the samples this method was slightly modified by taking two portions of the same sample, determining the moisture and fat in the one, as above given, and the ash and curd in the other as follows: After melting and dissolving the butter in benzine, the liquid was carefully decanted, so as to cause the curd, etc., to remain behind. Then the vessel was carefully heated until perfectly dry and incinerated and the residue weighed and determined as salt. The difference between 100 and the total percentages of fat, water and salt, was then called curd. With proper care, fairly accurate results--sufficiently so for the purposes of this article—can be obtained at a saving of much time.

In the following table (No. 1), will be found the analyses of a number of the higher priced brands of butter. They were all collected in Philadelphia and Delaware counties:

DESCRIPTION OF SAMPLE.

No. 14. A fine butter, made in December, 1897, in Chester county; was purchased by the writer in Lansdowne, Delaware county, and cost 35 cents.

No. 15. A high class butter, made in December, 1897, in Chester county; also purchased by the writer in Lansdowne and cost 40 cents.

No. 17. A table butter of exceedingly good quality; bought in Lansdowne; cost 35 cents; made in December, 1897.

No. 20. A high class brand, made in Philadelphia, according to label; uniformly even all the year round; cost 38 cents. This sample was made in December, 1897.

No. 21. A fine butter, purchased in Montgomery county, where it was made; price, 35 cents; made December, 1897.

No. 30. Fine table butter, bought in West Philadelphia; price, 35 cents; made in December, 1897.

No. 35. A fine table butter, bought in Philadelphia; made in Chester county; price, 38 cents.

No. 37. First class table butter, bought in Philadelphia; made in Berks county; cost 35 cents per pound.

No. 38. Fine table butter, made near Philadelphia; cost 35 cents.

No. 45. A good table butter, supposedly from New York State; cost 35 cents.

No. 46. No information as to its source obtained. It was of fairly good quality; price, 35 cents.

No. 65. Country creamery butter, two weeks old; cost 35 cents.

No. 66. Good table butter, made in Carbon county; cost 35 cents.

Nos. 74, 75 and 81. Good quality creamery butters. No other information obtainable; cost 35 cents; all recent makes.

No. 85. Fresh creamery, from the country, contains vegetable coloring matter but nothing injurious to health; price, 35 cents.

No. 86. A sample of "home-made butter," manufactured in one of the local milk establishments; cost 35 cents.

Nos. 88 and 90. Good fresh creamery butter from the country; cost 35 cents, each.

TABLE No. 1.—*Analyses of Highest Priced Butters.*

Number.	Fats.	Water.	Curd.	Salt.	Remarks—Physical Appearance.
14,	83.91	12.91	0.99	2.18	Even texture.
15,	85.21	12.69	0.68	1.42	Even texture.
17,	83.29	12.70	0.20	3.81	Even texture.
20,	87.21	10.52	1.15	1.12	Dry.
21,	87.57	8.82	0.96	2.65	Moist.
30,	84.68	12.29	0.58	2.45	Wet.
35,	84.36	13.49	1.00	1.15	Smooth and dry.
37,	83.92	13.14	0.73	2.21	Wet.
38,	85.82	11.47	0.70	2.01	Wet and even.
45,	89.11	8.59	0.40	1.90	Wet.
46,	85.69	11.22	2.05	1.04	Moist.
65,	81.30	11.52	5.30	1.88	Moist and granular.
66,	84.90	13.12	0.06	1.92	Moist.
74,	84.57	12.18	0.93	2.32	Compact and even.
75,	86.32	9.11	1.73	2.84	Outside salty.
81,	87.49	9.88	1.21	1.42	Even texture. Moist.
85,	85.57	10.13	0.54	3.76	Dry.
86,	83.94	14.62	0.30	1.14	Wet and white.
88,	85.95	11.00	1.34	1.71	Wet.
90,	84.82	11.81	1.26	2.11	Even texture.
Average,	85.29	11.56	1.10	2.05	

Of the above twenty samples, we find that one has less than 83 per cent. fats, four between 83 and 84 per cent., five from 84 per cent. to 85 per cent., five from 85 per cent. to 86 per cent., one from 86 per cent. to 87 per cent., three from 87 per cent. to 88 per cent., and one over 89

per cent. butter fats, showing that fourteen range between 83 per cent. and 86 per cent., and of the balance only one contains less than 83 per cent., which may be due to faulty manufacture, because of the large percentage of curd contained in the sample. The average is 85.29 per cent.

Water. We find two, each, between 8 per cent. and 9 per cent., 9 per cent. and 10 per cent., and 10 per cent. and 11 per cent., five from 11 per cent. to 12 per cent., five from 12 per cent. to 13 per cent., three from 13 per cent. to 13.5 per cent., and one over 14 per cent., showing that 13.5 per cent. water is a fair extreme limit for water. The average is 11.56 per cent.

Curd. Twelve samples contain less than 1 per cent., five between 1 per cent. and 1.5 per cent., and one, each, between 1.5 per cent. and 2 per cent., 2 per cent. and 2.5 per cent. and over 5 per cent. Two per cent. seems, from this, to be a fair extreme limit for curd. The average is 1.10 per cent.

Salt. Ten have from 1 per cent. to 2 per cent., six from 2 per cent. to 2.5 per cent., two from 2.5 per cent. to 3 per cent., and two over 3 per cent., showing that 2.5 per cent. would be a fair extreme limit of percentage in first-class butter. The average was found to be 2.05 per cent.

The following table, No. 2, consists of samples which, from their behavior, indicated that they were not melted butter, all of which cost less than 35 cents per pound or 9 cents per one-quarter pound, and over 28 cents per pound.

No. 16. Purchased in Lansdowne, as a good table butter; cost 32 cents.

No. 32. Bought in Philadelphia; made in Berks county; price, 30 cents; print butter.

Nos. 33, 36. Bought in Philadelphia; table butter; cost 30 cents.

Nos. 41 and 47. Bought in Philadelphia at 28 cents; made in New York State; quality fair; price, 28 cents.

Nos. 44 and 47. Two other New York samples; like previous ones; cost 30 cents.

No. 64. "Country butter," two weeks old; cost 16 cents per half pound.

No. 68. Cost 28 cents per pound. Dealer "forgot" where he bought it; it was a genuine butter.

Nos. 70, 78, 79, 82, 83, 89, 98, 97, all "creameries from the country;" cost 8 cents each; all said to be Pennsylvania butters.

No. 71. Obtained no information; cost 8 cents per quarter pound.

No. 72. "Good creamery;" cost 8 cents per quarter pound.

No. 76. Berks county butter; 17 cents per half pound.

No. 80. "First class;" 8 cents per quarter pound.

No. 84. Fancy butter, reprinted; 8 cents per quarter pound.

No. 87. Creamery from country; made last spring; 8 cents per quarter pound.

Nos. 92, 95. Good creamery; 8 cents per quarter pound.

Nos. 93, 94. Good creamery from Pennsylvania, recently made; 8 cents per quarter pound.

No. 96. Good country creamery; 7 cents per quarter pound.

No. 99. Fresh made creamery; 8 cents.

No. 100. "Finest butter to be had;" a print butter; 30 cents per pound.

TABLE NO. 2.—*Analyses of Medium Priced Dairy Butters.*

Number.	Fats.	Water.	Curd.	Salt.	Remarks—Physical Appearance.
16,	84.86	11.61	0.54	2.99	Moist. Even texture.
32,	81.33	13.61	3.30	1.76	Moist. Even texture.
33,	87.34	9.16	2.16	1.34	Moist. Even texture.
34,	85.14	12.50	0.38	1.98	Dry. Even texture.
36,	81.16	14.75	1.97	2.12	Moist.
41,	85.65	5.38	6.95	2.02	Dry.
44,	92.50	5.12	0.67	1.71	Smooth and even.
47,	91.38	6.53	0.89	1.20	
64,	88.24	8.83	0.22	2.71	Granular.
68,	87.88	9.85	1.16	1.11	
70,	86.11	9.31	0.51	4.07	Wet.
71,	85.01	10.70	1.35	2.94	Wet.
72,	90.07	5.50	1.19	3.24	Wet.
76,	88.57	9.10	0.09	2.24	Firm, dry and hard.
77,	88.35	8.66	1.33	1.66	Compact, slightly granular.
78,	86.19	10.62	1.21	1.98	Moist; even texture.
79,	83.42	12.47	1.41	2.70	Moist; even texture.
80,	85.21	11.16	1.08	2.55	Moist; even texture.
82,	87.17	7.94	1.02	3.87	Moist and even; granular.
83,	85.52	7.93	2.00	4.55	Moist and even; granular.
84,	87.82	8.33	1.10	2.75	Rancid and uneven.
87,	87.22	9.45	0.90	2.43	Dry.
89,	83.64	11.76	1.25	3.35	
91,	87.80	9.94	0.85	1.41	Even texture.
92,	84.12	9.10	3.17	3.61	Moist and salt.
93,	87.17	10.67	1.00	1.16	Moist.
94,	88.98	7.45	1.00	2.57	Moist and salt.
95,	89.22	8.20	0.77	1.81	Moist.
96,	84.47	11.74	0.89	2.90	
97,	87.01	10.56	0.73	1.70	Moist.
98,	85.02	11.21	1.30	2.47	Wet.
99,	89.44	7.45	1.11	2.00	Wet.
100,	87.86	7.78	1.55	2.81	
Average,	86.69	9.54	1.36	2.41	

In the above thirty-three samples there are three that contain 90 per cent. or more of fats, two from 89 to 90 per cent., four from 88 to 89 per cent., nine from 87 to 88 per cent., two from 86 to 87 per cent., six from 85 to 86 per cent., three from 84 to 85 per cent., two from 83 to 84 per cent., and two below 81 and 82 per cent. fats, showing that thirty-one samples out of the thirty-three contain over 83 per cent. of fats. The average precentage is 86.69 per cent. of fats.

Water. One sample contains over 14 per cent., one between 13 and 14 per cent., two from 12 to 13 per cent., five from 11 to 12 per cent., four between 10 and 11 per cent., seven between 9 and 10 per cent., four from 8 to 9 per cent., five from 7 to 8 per cent. and four under 7 per cent., showing that 13.5 per cent. would be a fair extreme limit for water. The average percentage of water is 9.54 per cent.

Curd. One contained nearly 7 per cent., two between 3 and 3.5 per cent., two between 2 and 3 per cent., two between 1.5 and 2 per cent, fourteen between 1 and 1.5 per cent., nine from 0.5 to 1 per cent. and three under 0.5 per cent., showing that about 2 per cent. would be a fair limit to curd. The presence of excess of curd tending to putrefaction makes it desirable to have the percentage as small as possible. The average percentage of curd is 1.36 per cent.

Salt. Two contained over 4 per cent., three over 3 per cent., fifteen between 2 and 3 per cent. and thirteen from 1 to 2 per cent., showing that for fresh buters 2½ to 3 per cent. would be a very fair limit. The average percentage is 2.41 per cent. salt.

The following table, No. 3, consists of samples which, from their behavior, indicate that they were not melted or fused butters; all of these cost less than 28 cents per pound. They were all samples purchased in cheap groceries as "best butter." No information was obtainable as to their source:

TABLE No. 3.—*Analyses of Samples of Cheap Dairy Butters.*

Number.	Fats.	Water.	Curd.	Salt.	Remarks.
55,	84.17	11.83	2.31	1.69	Inferior quality as to taste, etc.
60,	84.57	10.79	2.13	2.51	Inferior quality as to taste, etc.
Average,	84.37	11.31	2.22	2.10	

Even these butters come close up to standard as to curd, percentage, etc.

The following table, No. 4, consists of samples which, from their behavior, indicate that they were "melted" or "fused" butters:

Besides other samples, all process butters are included in this list. All of the samples were bought in Philadelphia, in the smaller establishments. No. 53 was not bought, but obtained indirectly as a sample.

The samples Nos. 2 to 13, inclusive, and No. 18 are all process butters, made either here or elsewhere.

No. 39. A butter, guaranteed as best; had a special brand and cost 15 cents per half pound.

No. 40. A tub butter; cost 6 cents per quarter pound.

No. 43. A tub butter; cost 8 cents per quarter pound.

No. 48. Butter, cost 6 cents per quarter pound.

No. 49. Butter, cost 6 cents per quarter pound.

No. 53. A sample of process butter.

No. 67. Cheap creamery butter; 13 cents half pound.

No. 69. Cheap creamery butter from the country; 6 cents per quarter pound.

No. 73. A tub butter; 6 cents per quarter pound.

TABLE No. 4.- *Analyses of Butters which gave evidence that they had been Fused or Melted.*

Number.	Fats	Water.	Curd.	Salt.
2,	78.79	16.21	1.80	3.20
3,	77.95	17.57	1.34	3.14
4,	78.32	15.77	1.46	4.45
5,	86.63	9.43	1.79	2.15
6,	88.52	7.10	2.11	2.27
7,	86.39	10.14	1.78	1.69
8,	81.27	13.99	1.55	3.19
9,	79.83	16.47	....	....
10,	85.55	10.57	3.64	0.24
11,	82.90	12.57	1.80	2.73
12,	83.33	10.37	3.03	3.27
13,	88.24	8.32	1.15	2.29
18,	88.82	11.60	1.90	2.68
39,	88.33	8.07	1.84	1.70
40,	87.53	10.62	1.13	0.72
43,	87.04	7.37	2.84	2.75
48,	90.65	5.70	1.64	2.01
49,	87.66	7.38	2.60	2.36
53,	84.41	11.35	1.88	2.36
67,	84.55	11.48	1.71	2.26
69,	82.96	12.35	1.41	3.28
73,	82.28	14.16	1.56	2.00
Average, 22 samples,	84.40	11.29	1.90	2.42

Of the above twenty-two samples, we find that one contains between 77 and 78 per cent. of fats, two between 78 and 79 per cent., one between 79 and 80 per cent., one between 81 and 82 per cent., three between 82 and 83 per cent., two between 83 and 84 per cent., two between 84 and 85 per cent., one between 85 and 86 per cent., three between 87 and 88 per cent., three between 88 and 89 per cent., one between 90 and 91 per cent., and two between 86 and 87 per cent. The average was 84.40. The irregularity in figures of these samples is at once apparent. No data can be deduced from them excepting that even in the case of melted butters, by far the larger number of samples contain over 83 per cent., and of those containing less than 83 per cent. there are only five under 82 per cent.

Water. One sample contains less than 6 per cent., three between 7 and 8, two between 8 and 9 per cent., one each between 9 and 10 per cent., 13 and 14 per cent., 14 and 15 per cent., 15 and 16 per cent., 17 and 18 per cent., two between 12 and 13 per cent., four between 10 and 11 per cent., three between 11 and 12 per cent. and two between 16 and 17 per cent. The average is 11.29 per cent. In spite of the irregularity of these figures it is visible at once that 13 to 13.5 would be a very fair limit to butters of this nature.

Curd. The curd in only twenty-one samples were determined. Of these five contain less than 1.5 per cent., eleven between 1.5 per cent. and 2 per cent., three between 2 and 3 per cent. and two between 3 and

4 per cent., showing that the amount of curd can also readily be kept within the limit of 2.5 per cent. The average is 1.90 per cent. curd.

Salt. The salt in twenty-one of the samples gave two having less than 1 per cent., two less than 2 per cent., eleven between 2 and 3 per cent, five between 3 and 3.5 per cent. and only one over 4 per cent. The average is 2.42 per cent. This also shows that from 2.5 to 3 per cent. would make a fair limit to percentage of salt.

The following table, No. 5, comprises a list of miscellaneous samples of butters, none of which seemed to have been remelted.

Nos. 1, 5 and 9 were bought as "best June butter," at 8 cents per quarter pound, 57, 58 and 62 as best butters, at 8 cents per quarter pound, and 61, 63 and 56 as best butters, at 7 cents per quarter pound. The others were reported as follows:

No. 19. Was an unfused reprinted June butter of good quality; price, 32 cents per pound.

No. 22. A fresh butter.

No. 23. An unfused reprinted butter.

No. 24. Bought by dealer as tub butter and made by him into prints.

No. 25. A print butter from Lancaster county.

Nos. 26, 27, 28 and 29. Inferior butters from the West, from Indiana.

No. 31. Ordinary cooking butter.

No. 42. A sweet tub butter; 50 was a cold-storage butter and 51 sold for baker's use.

No. 52. A butter which was made from the collected creams of many dairies.

No. 54. A New York butter.

TABLE NO. 5.—*Analyses of Miscellaneous Samples of Butter.*

Number.	Fats.	Water.	Curds.	Salts.
1,	87.05	9.51	1.01	2.43
19,	86.83	11.13	0.89	1.15
22,	86.82	9.04	1.34	2.80
23,	84.33	12.49	1.49	1.69
24,	92.22	4.93	2.08	0.78
25,	88.04	9.46	0.40	2.10
26,	91.65	6.71	0.65	0.99
27,	91.54	5.90	0.96	1.60
28,	84.59	12.49	1.94	0.98
29,	84.25	12.65	2.18	0.92
31,	82.86	12.34	2.67	2.13
42,	65.23	32.74	1.68	0.35
50,	86.83	10.29	1.48	1.40
51,	86.08	10.78	2.11	1.03
52,	85.70	10.42	1.77	2.11
54,	88.81	6.11	3.34	1.74
56,	81.31	15.58	1.21	1.85
57,	84.29	12.60	1.25	1.86
58,	83.09	12.07	2.73	2.11
59,	81.24	14.13	2.59	2.04
61,	86.07	10.77	1.17	1.99
62,	85.03	8.10	3.59	3.28
63,	88.25	7.79	1.62	2.34
Average,	85.30	11.23	1.75	1.71

Of the above twenty-three samples, we have one that contains over 92 per cent. of fats, two between 91 and 92 per cent., three between 88 and 89 per cent., one between 87 and 88 per cent., five between 86 and 87 per cent., two between 85 and 86 per cent., four between 84 and 85 per cent., one, each, between 82 and 83 per cent. and 83 and 84 per cent., two between 81 and 82 per cent. and one under 81 per cent., showing that only four run under 83 per cent. of fats. If the unfinished sweet tub butter, No. 42, be excepted, it will be seen that there are practically only two samples which are about 1¾ per cent. below the 83 per cent. standard, and all the rest either very close to that figure or else considerably above the same. The average percentage was 85.30 per cent.

Water. One sample, No. 42, has 32.74 per cent.; the others are as follows: One from 4 to 5 per cent., one from 5 to 6 per cent., two from 6 to 7 per cent., one, each, from 7 to 8 per cent., 8 to 9 per cent., 11 to 12 per cent., 14 to 15 per cent. and 15 to 16 per cent., three from 9 to 10 per cent., four from 10 to 11 per cent., six from 12 to 13 per cent., showing that only three contain over 13 per cent.

Curd. Four samples were found to have less than 1 per cent., seven from 1 to 1.5 per cent., four from 1.5 to 2 per cent., three from 2 to 2.5 per cent., three from 2.5 per cent. to 3 per cent. and two over 3 per cent. The two between 2.5 and 3 per cent. are so close to 2.5 per cent. that they might be classed with the same, hence, from 19 to 21 samples out of the 23 show a percentage in curd of about 2.5 or less. The average is 1.7 per cent.

Salt. One sample had over 3 per cent., one between 2.5 and 3 per cent., seven under 2.5 and over 2 per cent., nine between 1 and 2 per cent. and five under 1 per cent. The average is 1.73 per cent., showing that 2.5 to 3 per cent. should be ample for the amount of salt in butter.

If we now summarize the whole series of tables, we can obtain the following data:

Out of 100 samples examined, there were 78 unmelted and 22 melted butters.

Of These the Number Having—		Unmelted.	Melted.
Fat, ...	Less than 80 per cent.	1	4
	80-81 per cent.	0	0
	81-82 per cent.	5	1
	82-83 per cent.	1	3
	83-84 per cent.	7	2
	84-85 per cent.	14	2
	Over 85 per cent.	50	10
	Under 83 per cent.	7	8
Water, ...	Less than 10 per cent.	33	7
	10-12 per cent.	23	7
	12-13 per cent.	13	2
	13-14 per cent.	4	1
	Over 14 per cent.	5	5
	Over 13 per cent.	9	6
Curd, ...	Less than 1 per cent.	28	1
	1 to 1.5 per cent.	26	5
	1.5-2 per cent.	7	11
	2-3 per cent.	11	3
	Over 3 per cent.	6	2
Salt, ...	Less than 1 per cent.	5	2
	1-2 per cent.	33	2
	2-3 per cent.	32	11
	Over 3 per cent.	8	6

The conclusions which may be derived from the above figures are self evident. If the one sample, No. 42, in table No. 5, be excluded from consideration and it be borne in mind that of the six remaining samples, the only one of the higher priced butters containing less than 83 per cent. of fat was one that was faultily manufactured, as is indicated by the excess of curd, etc. (No. 65, Table No. 1), and that the same might be said of samples No. 36 and 32 of Table No. 2, there remain only three samples of inferior quality which do not reach an 83 per cent. butter fat standard, to which any dairyman can easily bring his butter.

The percentage for water, according to the results obtained, should not exceed 14 per cent. at the very most, the standard adopted by Oregon.

As to curd, over two-thirds contain less than 1.5 per cent. and less than 8 per cent. of the total number of samples contain over 3 per cent. Of these, two are among those low in fats. Eight of the eleven samples, containing between 2 and 3 per cent., are under 2.5 per cent., leaving only nine samples out of the whole lot over that figures, below which the curd in all butters should be reduced.

The percentage in salt is about right when kept below 3 per cent. Where butters are heavily salted, over that limit, they might be so designated, giving, at the same time, the maximum percentage. Hence, it may be concluded that any butter containing less than 83 per cent. butter fat should be deemed adulterated. Of foreign matter, none should have more than 14 per cent. water, 2.5 per cent. curd or 3 per cent. salt.

In conclusion, the writer wishes to express his acknowledgments to his assistant, Mr. J. Bertram Young, to whom he assigned the analytical portion of the greater part of this work.

MILK SUPPLIES OF PENNSYLVANIA.

By M. E. McDONNELL, M. S., *Assistant in Bacteriology and Chemistry, Penna., Experiment Station State College, Pa.*

SUMMARY.

1. General characteristics of bacteria, page 563.

2. Method of determining the condition of the city milk supplies, page 565.

3. Sources of bacteria in milk, page 566.

4. All milk pails and vessels should be scalded or steamed before use. The first stream from every teat should be milked on the ground and so far as possible all dust should be excluded from the milk supply, (page 567).

5. All milk should be aerated while fresh and warm to remove the animal odor and prevent the possibility of the development of milk poisons, (page 570).

6. Cooling should be done as quickly as possible after milking, (page 571).

7. Pasteurization should be resorted to when there is a possibility of infection with disease-producing organisms or when old milk must be used for infants. (571).

8. The use of chemicals or so-called "preservalines" in milk should be positively prohibited. (Page 575).

9. When ice is used, the application should be made in such a manner as to produce efficient cooling, the vessels being surrounded by substances that are not rapid conductors of heat. (Page 576).

10. Bottling milk on the farm aids in keeping it in the normal condition and making it a wholesome food. (Page 577).

11. Milk should be delivered to the consumers while fresh. (Page 578).

12. Light and ventilation in the barn greatly diminish the danger of infection from tuberculosis. (Page 579.)

13. Polluted water must not be used for washing milk vessels on account of the danger of an outbreak of typhoid fever or some other disease through the milk supply. (Page 580.)

14. Persons suffering from or coming in contact with infectious diseases should not touch the milk supply and milk from all diseased animals should be rejected. (Page580.)

15. Cleanliness is necessary at all retail milk stores. (Page 581.

16. The number of bacterial in milk from different sources shows that an official inspection of the condition of all places where milk is produced or handled is beneficial. (Page 582.)

17. Rigid inspection greatly diminishes the adulteration of milk by skimming, watering and chemicals. (Page 583.)

All are familiar with the opaque, yellowish-white appearance, and the faintly sweetish taste of fresh milk, and with the fact that upon standing for some time it usually becomes sour to the taste, acquires a characteristic odor, and, upon standing for a longer period, curdles; nor is it uncommon to see milk of a slimy or somewhat syrupy consistency, so that if a finger were drawn through it long strings or threads would be drawn out and it will not run back into a vessel as normal milk or water will do.

Moreover, it is commonly known that tuberculosis, typhoid fever and diarrhoea in infancy are sometimes caused by the quality of milk; while milk-poisoning, ice cream poisoning and cheese poisoning are other serious results of the use of defective milk.

All of the above changes and troubles may be due to bacteria and some of them are always due to these micro-organisms. All putrefaction is due to the action of bacteria. They may be a scourge to us in some ways, but they are essential to bringing about many necessary changes and in most cases come to us as friends. The ripening of cream and cheese is due to their presence; the fine flavor and aroma of butter are also due to the action of desirable species. The importance of their action is so clearly recognized that some special varieties are now placed upon the market for the purpose of producing certain desirable changes and preventing those which are undesirable. In other words, bacteria are to the butter and cheese maker what yeast is to the baker and brewer. The housewife cannot make good bread when her yeast is bad. She recognizes this fact and in such cases gets good yeast from a neighbor, or compressed yeast from the grocer. The butter and cheese maker must do the same thing—that is, remove the bad species of bacteria by proper care of the milk and introduce good ones, not necessarily by buying cultures, but by having perfect sanitary conditions in all of the dairy surroundings. It may be necessary in some cases to introduce desirable varieties from an old cheese factory or from milk that possesses the proper kind of ferments.

The milk dealer is on a different footing. His object should always be to prevent the growth of all organisms in the milk. Milk in the udder of a healthy animal is free from all living organisms and it should be the object of every dealer to keep his cows in a good healthy condition, and to supply the milk to customers as nearly normal and pure as it can be maintained.

The purpose of this report is to consider what these organisms are, their effect on milk, and the methods by which our Pennsylvania supplies can be so improved as to command the confidence of the consumer.

Before proceeding, I wish to express my thanks to Dr. H. P. Armsby for the valuable suggestions he has made to me throughout the investigation. I desire also to extend my thanks to Dr. Leonard Pearson for his suggestions and the use of the University of Pennsylvania Veterinary Laboratory, each of the respective city health officers and food inspectors for their help, the milk dealers who placed their facilities at my command and many others, who, in different ways, made it possible to gain the desired information.

It is realized by all that milk is a most valuable food and the amount consumed will be largely increased when it is known that our markets supply a product that may be safely used.

GENERAL CHARACTERISTICS OF BACTERIA.

By the term bacteria, which has been used so frequently in the preceding pages, is meant the micro-organisms which are composed of very minute cells, making up the lowest plane of vegetable life. Since each individual is composed of but one cell, the average diameter of which is but 1-25,000 of an inch, their structure is necessarily very simple and they may all be classified under the following sub-divisions: Those resembling a ball and known as coccus; bacillus or bacterium, corresponding to a short rod; and spirillum, which is a curved rod, or, as the word signifies, a small coil. These cells may remain completely isolated from each other or connected in groups of a definite combination forming a chain of cocci (round cells), a thread of rod cells or some other definite combination; the same microbe may also assume different shapes at different stages of its existence, or on cultivation in different media and surroundings, but with the same species one form usually predominates, so that the shape and arrangement of cells aid in identifying the organisms.

The accompanying figure shows the common arrangement of bacteria cells.

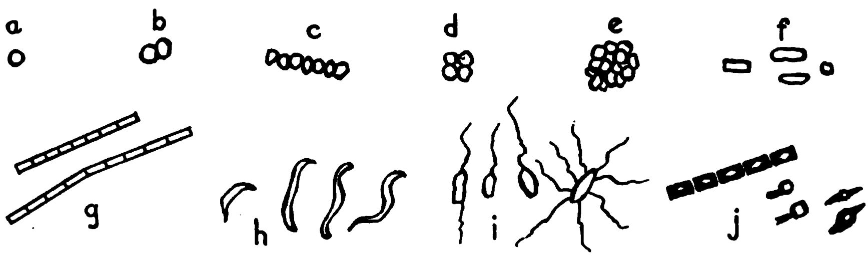


Fig. I. Bacteria, magnified to various extents.

a, represents a coccus.
b, represents a diplococcus or twin coccus.
c, represents a streptococcus, i. e. a chain of cocci.
d, represents tetrads.
e, represents stapyhlococci, i. e. they resemble a bunch of grapes.
f, represents bacilli (small rods).
g, represents bacilli in threads.
h, represents spirilli.
i, represents bacteria with flagella or motile organs.
j, represents bacteria with spores.

The exact shape of an organism is not so important as a knowledge of its mode of reproduction, the conditions under which it will grow and what it will actually do. Under the microscope many common, harmless germs appear much the same as some one of the virulent disease bacilli.

Bacteria reproduce in two ways, first, by simple fission or division, that is, the mother cell becomes somewhat elongated and becomes narrower and narrower in the middle until it is finally divided into two identical parts. All bacteria reproduce in this manner when their food supply and other conditions for growth are good. Or, second, some species have the power to multiply by another process, known as spore formation or what might be called seed formation. In this process, one germ forms one spore or seed. This spore may be formed in the center of a cell and have the appearance of a light glistening dot under the miscroscope (endogenous formation), or the entire germ may become transformed into a spore (known as an arthrospore).

Bacteria never form spores when the conditions for growth are favorable, but this process is nature's method of tiding over starvation periods, or atmospheric conditions that vegetating cells cannot endure. Species of organisms that do not form spores are nearly all killed when subjected to a temperature of 155 degrees F. for fifteen minutes, while many spores resist a boiling temperature for hours.

All spores vegetate, forming new germs, when suitable conditions again prevail, just as seed wheat sprouts and grows when planted in moist soil under proper conditions. These facts will be taken up and discussed more fully under "pasteurization" and "sterilization" of milk.

Bacteria may be motile or non-motile. The motile ones are variable in rapidity and propel themselves through liquids by means of hair-like appendages known as "flagella." These flagella (see Fig. 1, i) act as oars and propel the organism by a lashing movement.

Bacteria require food just as other plants do. Some grow in the presence of air only and are known as obligate aerobes, while others grow only when the air or oxygen is excluded and are poisoned by contact with it; these are obligate anaerobes. Again, many species are facultative aerobic and anaerobic, that is, they will grow regardless of the absence or presence of air.

Many species grow at all ordinary temperatures, while others require a definite amount of heat and will not develop unless the temperature is that of the human body, or some other standard temperature. Light is destructive to many species, especially to those producing putrefaction and tuberculosis, while on many other varieties it has no effect. All organisms require moisture in order to develop. Some bacteria are killed by drying; others (e. g. tuberculous), are uninjured by this treatment.

Bacteria may be parasitic or saprophytic. The former derive their nourishment from living things, while the latter subsist on what they derive from decaying matter. Others are facultative; that is, they can live on either kind of food. Pathogenic germs are those which cause various diseases.

The saprophytes are important to us on account of inducing fermentation in so many of the industries, such as the ripening of cream and cheese. They also cause all putrefaction, disintegrating the organic matter of dead animal and vegetable formation and converting it into the original elements used for growth.

METHOD OF EXAMINING THE CITY MILK SUPPLIES.

The supplies of Philadelphia, Reading, Harrisburg, York, Altoona, Pittsburgh, Allegheny, Erie, Scranton, New York and Williamsport were examined. In every case the city health officer, or the officer in direct charge of the city milk inspection was consulted so as to learn the exact system of inspection by which the people are protected. Representatives of all classes of city milk dealers were consulted so as to learn how these products are actually handled and what obstacles must be overcome in order to furnish first-class milk to the consumers. Samples of all classes of milk were taken for examination. Part of these samples were taken from milk which was purchased for the special purpose of determining the character of the milk as it is retailed. In many cases the municipal inspector or police officer accompanied me to places where milk was kept for sale, and in every such case a sample was taken from the can out of which milk was being sold at the time of our inspection.

In taking a sample, all the information possible was obtained, such as the age of the milk, the place of production and the manner in which it was kept. The samples were taken in sterilized, three-ounce "French square" sample bottle. These were carried in a zinc case containing twelve pockets made especially for the sample bottles used, and a closed chamber for ice or ice and salt. This was enclosed in a woolen bag made a size to fit the case nicely, while the complete outfit was carried in a twelve-inch grip.

Before starting to collect samples, the refrigerator in the sample case was either filled with ice or a mixture of ice and salt. Ice alone was sufficient to reduce the samples below 45 degrees F., and when ice and salt were both used the temperature was found to be below 35 degrees F. on arrival at the place of conducting the test. Three hours was the longest period that elapsed between taking the samples and making the gelatine cultures.

When it was known that the inoculations could be made immediately, ice alone was used, but if the place of taking the samples was

some distance from the place where the tests were conducted, both ice and salt were used. This was done in order to keep the organisms already in the milk from multiplying after securing them from the dealers.

The number was determined as follows: Before collecting the samples, graduated flasks holding 500 or 1,000 cubic centimeters were filled with water, plugged with cotton and sterilized. One cubic centimeter of the sample to be examined was then put into this sterile water by means of a graduated sterilized one cc. pipette, and the two liquids thoroughly mixed by shaking. A definite quantity of this diluted milk, say 1 cc., was then added to a sterile Petri dish (a flat-bottomed dish approximately three inches in diameter with a closely-fitting glass cover) containing liquified, sterile, nutrient gelatine, and after thoroughly mixing by careful agitation, the gelatine was quickly solidified by placing the dish in a flat tin pan and floating in ice water. By solidifying the gelatine, all the bacteria were held fast just as a fish would be in a cake of ice. The medium was solidified quickly in order to prevent an increase in the number of bacteria while it was still in the liquid condition. It was then held at a room temperature to allow the bacteria to grow. The medium being solid, every organism was held where it was originally lodged on solidification, and if the mixing was complete, two germs could not be together. After this stage of operation, every organism would be so situated that it could grow unmolested by others, just as one hill of corn grows independently of its neighbor. After a growth of from two to ten days they were examined. Every organism that grew had made its own colony, the nature of which depended upon the nature of the organism composing it, and by counting all of these spots or colonies, the number of bacteria in the milk was determined.

To count the number, the dishes were placed on a black glass plate which was ruled in squares, and the counting was done by the aid of a small hand magnifier. Where possible, the number in the entire plate was counted. When this number was too large it was estimated by counting five to twenty squares in different parts of the plate and calculating the number in all the squares.

If one cubic centimeter was diluted to one thousand, and one cubic centimeter of this dilution taken for the plate culture, we would have only 1-1,000 cc. of milk in our gelatine. Suppose 100 colonies developed in the plate from 1-1,000 cc. of milk, then one cc. would contain 100 times 1,000, or 100,000 bacteria.

Two or three gelatine plate cultures were made, in every case using different amounts of milk, so that one of the plates would be likely to contain the best number of colonies for counting. The milk had to be largely diluted in every case, so that a small enough number of organisms could be obtained for counting. Undiluted milk will make

the medium opaque, rendering it impossible to count the colonies; hence, dilution was necessary in order to keep the cultures transparent.

In every case gelatine was inoculated with the water used for diluting the samples of milk to ensure that the organisms were not from this source. All samples, bottles and apparatus used in these experiments were sterilized before use.

The appearance of the milk was then noted and the specific gravity taken by means of the Westphal balance, an instrument devised for taking the specific gravity of all liquids, this method having been adopted as official by the Association of Official American Agricultural Chemists. The per cent. of fat was determined by the Babcock method. The total solids were calculated according to the latest formula of Richmond and Hehner, which was published in the report of the Pennsylvania Agricultural Experiment Station for 1897.

The amount of lactic acid was determined by the use of Fanington's tablets, or by means of a standard solution of caustic soda, using a two-per cent. phenol-phthalein solution as an indicator. In all cases where the acidity of the milk corresponded to more than twenty-two hundredths per cent. lactic acid and in some other cases, examination was made for all the common preservatives (chemicals used to make milk keep longer). The samples which were probably skimmed or watered were also noted.

A record of the official atmospheric temperature was taken on all the days when samples were taken so as to determine the effect of this on the bacterial content. From these results was taken the report which we now give, and when suggestions are given, it is with the hope that they may be of value to the reader.

THE PROTECTION OF MILK FROM INFECTION.

Milk contained in the udder of a healthy animal is sterile. It would remain sweet indefinitely were it not removed from the animal, but on removal it becomes contaminated and the organisms from the contamination multiply in the milk, causing it, by their activity, to sour. Milk affected in this way may be sterilized by heat or chemicals and it will then remain sweet indefinitely if the access of more organisms is prevented. Any one can try this experiment for himself by taking a clean glass flask, plugging the neck with cotton and heating in an oven to a temperature of 300 degrees F. for one hour, then filling with good sweet milk and replacing the plug. The flask should then be placed in an atmosphere of steam (this may be done by putting it in a tin pail containing about an inch of water, covering, and boiling the water) for about thirty minutes on four successive days. The cotton plug must never be removed to admit more germs. The first boiling kills all bacteria, but most spores are not injured. These nearly all

develop to such an extent that they will be killed on the second day. On the fourth day it is probable that the milk will be absolutely sterile. If this experiment is successfully performed, the milk will remain sweet for weeks.

From the time milk leaves the udder of the cow it is subject continually to chances of contamination. The external parts of an animal are always covered with millions of bacteria. The milk ducts form an excellent harbor in which they can grow and the first stream of milk removes hundreds of them. This is a source of contamination throughout the milking. In some cases the hind quarters and udders are literally covered with stable and barn-yard filth. Then, too, cows are very often milked in a shed or barn which is saturated with excrement and filth. The bedding of animals forms an excellent medium in which bacteria may develop. Milk pails and vessels are frequently bad sources of contamination. They may apparently be thoroughly cleansed and at the same time be entirely unfit to contain milk. Infection may also come from the hands and clothing of the milker. Again, milking is often done when the barn is very dusty from the feeding of the animals, and in many cases the milk is strained and aired in the room where the milking is done. After it has been shipped, many dealers keep it in open vessels on or near the counters, where it is exposed to dust and odors from other things. The presence of street dust has been demonstrated by a number of investigators.

The sources of infection have been enumerated because contamination from any one of them causes the quality of the milk to deteriorate more rapidly, thus increasing the chances for loss to the dealer and injury to the consumer.

A large number of bacteria found in milk which has been kept at a reasonably low temperature signifies that the product either contains dirt or has become old. If sterile milk cannot be obtained, everything should be done to keep the number as low as possible. The following is a method for reducing the infection from these sources to a minimum:

All of the suggestions are practical and with one exception are made use of daily at our own State Experiment Station Dairy.

I. To diminsh the bacteria content of the milk supply coming from the milk ducts, the first stream from each teat should be milked on the ground.

II. To diminish the amount of contamination due to particles dropping from the udder, belly and hind quarters, these parts should be brushed and rubbed, preferably with a damp sponge, just before milking, allowing enough time for the dust so raised to subside before placing the pail under the cow.

III. Infection from the barn and bedding can be largely reduced by

having good light, air and white-washed walls (these two agents act as strong disinfectants), by keeping the barn clean and by milking when there is a minimum amount of dust floating in the air.

The cows should not be given feed that would create dust at this time. At this point, it is suggested that dairymen having large herds might have a special milking room into which the cows could be taken for this purpose only. A very small room could be used and it could be thoroughly lighted and ventilated and free from bedding and matter that would give rise to dust. Following this plan, the whole herd would not be present to produce floating dust by their movements and feeding would not interfere with milking. This small room could receive attention that it is impossible to give to a whole barn and the cows might be watered in such a room.

IV. All milk pails and vessels should be thoroughly cleansed by at least washing with boiling water, and where steam is accessible, they should be surrounded by an atmosphere of this for ten or fifteen minutes. Cold water will not kill any of the organisms in the vessels, and acts only by mechanically removing them, and, also, the vessels retain some of the organisms present in the water. Hot water and steam to a greater degree kill the vegetating germs present. At every large milk depot visited during the inspection, when steam was used for cleansing the vessels were simply inverted over a jet of steam for a few seconds. By this process the vessels would not be sufficiently heated to kill many germs; continuous application for some minutes should be made. This may be done by leading live steam into a closed chamber which will hold a number of vessels at one time without making the work any more difficult. At the Experiment Station creamery such a sterilizer is used daily. It consists of a cheap closet with several removable racks. A steam pipe is conducted through the floor of this so that the entire chamber can be filled with steam. It is simple in construction and easily manipulated, while the results are excellent.

V. Wooden milk vessels should not be used. Pressed tin vessels are most desirable, they being more easily sterilized than those made of other material. All joints should be completely filled with solder so that dirt cannot accumulate in them.

VI. The hands and clothing of the milker should be clean, and no one affected with, or working in a room where there is a contagious disease, should have anything to do with the milk. The hands should be dry while milking, and a white suit that will show all dirt is to be preferred. Such a suit can be made large enough to slip over the other clothes readily, and should be used for no other purpose.

VII. Milk should be removed from the barn as soon at it is drawn from the udder, taken to a clean side-room or the milk house and strained and aerated while still warm.

VIII. It should then be cooled quickly to retard the development and multiplication of bacteria.

IX. It should be kept in a room where the atmosphere is pure and free from all odors.

X. It should be protected from all kinds of dust at all times.

These precautions aid in preserving the original qualities of milk, thus giving a better product, regardless of the use to which it is to be put.

AERATION OF MILK.

More milk dealers were found to complain of "smothered milk" than of any other trouble. Many shippers pour or strain the milk into cans quickly, often before it has been removed from the barn, and close the shipping cans quickly, while the milk is still warm. By the time it has reached the dealers, such milk has probably acquired an unpleasant taste and an offensive animal odor. It is commonly known that when fresh milk is closed up in a tight vessel and deposited in a warm place, a very disagreeable odor and taste are developed; such milk may become poisonous by the development of tyrotoxicon. After a study of the conditions under which this poison develops in milk, Newton and Wallace* say in regard to a case of milk poisoning in a Long Branch hotel, which occurred in 1886, "the production of this substance (tyrotoxicon) was no doubt due to the management of the milk. That is, too long a time had elapsed between the milking and the cooling of the milk, the latter not being attended to until the milk was delivered to the hotel, whereas, if the milk had been cooled immediately after it was drawn from the cows, fermentation would not have ensued, and the resulting material, tyrotoxicon, would not have been produced."

While the milk is still warm, it should be removed to a room where the air is pure, and strained and aired. If a cloth is used for straining it should be changed frequently and if a metal strainer is used it should often be cleansed. Hot water or steam should be used in washing.

Milk may be contaminated from an unclean strainer and the organism retained by the solid matter on the filter will gradually wash off into the strained milk, hence, the need of frequent washing.

Grotenfelt† found that a double strainer made by placing a linen cloth on a metal sieve, gave the best results. If the milk is strained in an atmosphere of pure air, the animal odor will be removed, while if the air be foul, as it usually is in stables, the disagreeable odor may increase. The dust in the stable also makes it a very undesirable place in which to strain milk. It is better to strain and air the milk while warm, as then most of the animal odor and gases will be given up while, if the milk be cooled first, they will be largely retained.

* Ptomains and Leucomains; Vaughan and Novy.

† Principles of modern dairy practice. Grotenfelt-Woll.

All gases are more soluble in cold fluids than in warm ones, and as it is desirable to remove all of these from fresh milk, it should be aired while fresh and warm, nor should it be put into air-tight vessels while warm, but should first be subjected to an efficient cooling.

CHECKING THE ACTION OF BACTERIA IN MILK.

Cooling the Milk.—Milk should be cooled as soon as it is strained. While this does not kill any germs already present in the milk, it retards the growth of all organisms and if the cooling is efficient, acid fermentation or souring will be practically stopped. The temperature should be kept below 45 degrees F. Milk may be cooled by submerging the larger cans containing it in cold water, in which case it should be agitated. This may be done by means of a disc on a handle, which is manipulated like a churn dasher.

A number of the patented mechanical coolers are very valuable, the milk being quickly and uniformly cooled to a temperature differing only a few degrees from that of the water used by being passed through one of them. The air in the room where milk is cooled must be pure, especially if a large surface is exposed, for if the air is impure the contamination from this source may be great. Pure dust-free air contains very few germs and when the cooling is done in the right kind of a room the aeration of the milk due to such an exposure of the milk will prove beneficial.

At the Experiment Station creamery the milk is cooled daily by a process which consists essentially in passing it over a long metallic channel which is kept cool by a current of water from beneath, the milk thereby being thoroughly aired at the same time. The results obtained from such treatment have always been very satisfactory.

Pasteurization of Milk.—Pasteurization is a process made use of to retard the fermentation of milk, to reduce the number of common saprophytic bacteria and to exterminate all disease-producing germs, such as those of tuberculosis, etc. It is a partial sterilization. It also changes the character of the fermentation by destroying some of the ferments. The process consists in heating the milk to 149 degrees F. for thirty minutes, 155 degrees F. for fifteen minutes or 167 degrees F. for ten minutes, and then quickly cooling and airing it. The power of heat to destroy germs depends upon the duration of the exposure. At the Experiment Station creamery, it has been found that 155 degrees F. for fifteen minutes gives the most satisfactory results. It is not best to raise the temperature much higher than this on account of the danger of a permanent cooked taste and odor which is undesirable. This taste is due to a chemical change in the milk. One of the albuminoids, lactalbumin, is coagulated on heating from 158 degrees F. to 167 degrees F.; another one, lactoglobulin, coagulates when the milk is heated to from 158 degrees to 169 degrees F.; 155 degrees F. for fifteen minutes kills all vegetating germs in the milk and leaves only the spores of saprophytic bacteria.

Lactic acid producing bacteria do not form spores, hence, pasteurized milk will not become sour unless these germs gain admission after the heating has been discontinued. Nor can there be an outbreak of diphtheria, typhoid fever, tuberculosis or any other disease unless the specific germ is carelessly introduced after heating.

The spores of many common bacteria, especially of the class of organisms producing the unorganized rennet ferment, remain, and these develop, forming new vegetating germs. The milk slowly undergoes a change very similar to the one that would take place if rennet were gradually added to it. Coagulation takes place without the milk becoming sour.

An old lot of pasteurized milk may contain as many germs or even more than ordinary milk that would be too sour for consumption. On this account it may be misleading, for many people will use any kind of milk except what has become actually sour. It must be borne in mind that pasteurized milk should always receive the same care regarding cleanliness and low temperature as other milk, and it should be aired, cooled to 45 degrees F. or lower, as soon as pasteurization is complete. Cooling and airing accomplish two results, first, the slightly burnt taste and odor that all freshly pasteurized milk possesses is removed; second, the spores are prevented from germinating so quickly. At ordinary temperature these spores would infect the milk in a very short time, but a temperature below 45 degrees F. is very unfavorable to their development. In passing from 155 degrees to 45 degrees F. the most favorable temperature for the vegetation of almost all species of spores is passed. For this reason the cooling should be done quickly. In securing a pasteurization apparatus, it is desirable to have one in which the milk can be heated quickly and uniformly; the temperature should be under perfect control; the constuction should be such as to make reinfection impossible during the process. The machine must be easily manipulated and cleansed and a system of cooling should be used as was described for cooling and airing fresh milk, on page —.

The pasteurization apparatus used at the Pennsylvania Experiment Station creamery and dairy school consists of a vat for milk which is placed in a larger water chamber. The water is heated by a jet of live steam, indirectly heating the milk. The temperature of the water is easily controlled, the entire outer surface of the milk vat is heated moderately and there is no danger of a small quantity of milk becoming burned, thus giving the whole supply an undesirable taste and odor as would be the case were the heating done by direct contact with steam or a flame. A mechanical stirrer keeps the milk thoroughly agitated throughout the operation, thus keeping the temperature uniform and preventing imperfect or over heating of any portion. A thermometer is inserted through a perforation in the cover of the vat so that the temperature can be taken at any time.

After pasteurization the milk is immediately cooled by drawing off the hot water from the outer jacket and allowing cold water to run in, the milk being heated and cooled in the same vat, or the milk is drawn off while still hot and cooled and aerated by one of the methods for fresh milk described on page —. The milk is then put into steamed bottles for delivery to the patrons. The Station has found that such treatment gives very satisfactory results.

At a number of milk depots which were inspected, the milk was pasteurized in bottles. Two general forms of apparatus are used for this purpose; in the first one, the bottles are placed in a chamber of live

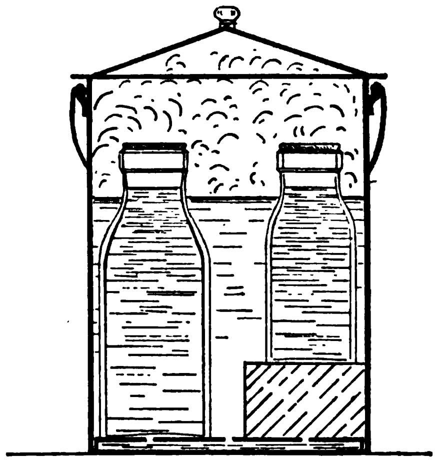


Fig. 2.—"A simple arrangement for pasteurizing milk for family use. A covered tin pail will serve as a receptacle for bottles and water. A shallow bench on which to set the bottles to keep them from "bumping" may be made from a tin plate punched full of holes. An inverted bowl or block wil serve to equalize level of milk in different sized bottles where such are used. Cover is removed when temperature of water is taken."

steam, in the second, such as the Shier's apparatus, they are surrounded by water and this is heated. The latter form is better on account of the greater ease with which the temperature can be controlled and the absolute uniformity throughout.

If it is desirable to pasteurize a small amount of milk either for general or infant use, the following method described by Dr. Russell may be used:*

1. "Use only fresh milk (not more than twelve hours old) for this purpose.

2. "Place milk in clean bottles or fruit cans, filling to a uniform level. (If pint and quart cans are used at the same time, an inverted dish or piece of wood will equalize the level.) Set these in a flat-bottomed tin pail and fill with warm water to same level as milk. An inverted pie tin punched with holes will serve as a stand on which to place the bottles during the heating process.

3. "Heat water in pail until the temperature reaches 160 degrees

* Wisconsin Experiment Station Bulletin 44.

F.; then remove from source of direct heat, cover with a cloth or tin cover and allow the whole to stand for half an hour.

4. "Remove bottles of milk and cool them as rapidly as possible without danger to bottles and store in a refrigerator."

"There are several devices that have been suggested for this purpose, but this simple method is quite as efficient as any other. Milk treated in this way ought to keep perfectly sweet for several days. The above diagram shows a simple form of apparatus that can be utilized for this purpose."

When milk can be obtained in a fresh condition from a source that is known to be pure and assurance is felt that it has been properly handled, pasteurization is unnecessary. It is cheaper and better to buy milk that does not require pasteurization. If, on the other hand, there is a chance that the herd producing the milk supply is infected with tuberculosis, or if there is an epidemic of some such disease as typhoid fever which can in any way be connected with the milk supply, pasteurization should be insisted upon. Pure, fresh, raw milk is the best for infants; if it must be kept before feeding, pasteurization will be beneficial. When the source of milk is unknown it is always safest to resort to pasteurization. In many of our Pennsylvania cities, even where the population is as high as 50,000, it is impossible to buy pasteurized milk. In many cases, what is found possesses a burnt taste and odor due to overheating. It should be obtainable in all our cities. Samples 183, 226, 271, 304, 305 and 306 were pasteurized or "sterilized." (See appendix.) The acidity of No. 183 was .135 per cent.; of 226, .14 per cent., and of 271, .17 per cent., an average of .148 per cent. The acidity of the other pasteurized samples was not determined. The average acidity of the unpasteurized milk was .19 per cent. These results show that the acid fermentation was checked in the commercial pasteurized milk.

The average number of bacteria in five of the above samples which were examined was 56,700. The average number of bacteria in 77 samples taken at different milk depots was 3,821,700, or 67 times as many as were found in the pasteurized milk. The average number of bacteria found in all of the 267 samples examined was 5,564,300, or nearly 100 times as many as the average number found in the pasteurized samples. Such a showing is very creditable to the pasteurized milk dealers.

If a dealer will take pains enough with his product to pasteurize it, he will usually take care of it in other respects.

Sterilized Milk.—Sterilized milk always possesses a cooked taste and odor and is an undesirable food. The albuminoids are materially changed by the high heat used and the milk is less easily digested. The samples of so-called "sterilized" milk found on the market are not sterile, but simply imperfectly pasteurized. That is, heated but once to a temperature slightly higher than pasteurization point.

It is doubtful whether there can ever be a material demand for sterilized milk.

The Use of Chemicals in Milk.—Preservatives were found as follows (see appendix):

Boracic acid or borax in samples 34, 96, 209, 220, 245 and 346. Soda in 37, 140, 176, 177 and 189. Formalin was found in No. 309. Twelve of the 352 samples taken, corresponding to 3.4 per cent., were found to contain chemical preservatives. Seven of these twelve samples were taken at restaurants and one of the seven was found to have been so treated by the retail dealer.

The average number of bacteria found in these twelve samples was 23,295,500 per cc. A comparison of these results with those of any other class of samples in which the number of bacteria was determined shows very conclusively that the very worst class of milk sold is that one in which chemical treatment has been resorted to. The average number found in all the samples taken was 5,564,300, or one-fourth that found in the class of milk containing chemicals. Since one-half of these samples were taken at restaurants, it might be more fair to make comparisons with the restaurant class of milk. The 32 samples of restaurant milk examined contained 11,961,700 bacteria per cc., or less than half as many as were found in the entire class of milk containing chemicals. Sample 346 might be taken as an exception by persons not knowing the circumstances. It was said to be morning's milk, and was taken from a wagon in Williamsport, where the average number of organisms per cc. in all wagon milk examined (14 samples) was only 95,400, so that even this most favorable sample cannot be construed into a recommendation for the use of borates, the basis of the most common preservative placed on the market at the present time. Sample 96 was secured at a well-known milk depot in Harrisburg, and No. 220 from what is considered a very good depot in Pittsburgh, yet both lots of milk had deteriorated too much from a bacteriological standpoint. The average number of bacteria found in samples taken from 77 milk depots was 3,282,200, while these samples contained 25,000,000 and 44,665,000 respectively. There are chemicals that will stop the growth of all micro-organisms, but all such compounds are probably poisonous to the human body or retard digestion. Some chemicals that are used to preserve milk retard the growth of one class of organisms but favor another.

Most organisms grow more rapidly in neutral or slightly alkaline culture media. Text books tell us to add sodium carbonate to an acid media in order to prepare it for the most rapid and complete growth of bacteria. The growth of rennet-forming bacteria is favored by alkalines. We see that five of the twelve samples were adulterated with soda, a chemical favorable to the development of bacteria when added to slightly acid medium. Soda conceals the deterioration of milk by neutralizing the lactic acid formed, thus preventing it from

becoming sour to the taste at the usual time. It also enables the acid-forming organisms to act longer. *"When the acid reaches about .8 per cent. bacterial development is checked. If the acid already formed is neutralized by a carbonate, the development will begin anew." * † ‡The germ of cholera does not thrive in milk on account of the lactic acid. The addition of soda aids in the growth of all such organisms.

The conclusions of different investigators do not seem out of place at this time:

*"Their general use is to be strongly deprecated," Dr. Russell.

†"The people do not want drugged milk," Dr. Conn.

‡"To prevent the use of such preservatives their employment should be prohibited," Dr. Ed. Von Freudenreich.

§"The time during which milk will remain sweet can be materially increased by the addition of certain chemicals without changing its taste," Hutchinson's Thesis.

||"Milk containing chemicals is often sold as improved milk, but ought properly to be called simply adulterated milk."

Their use is prohibited by France, Germany, Austria, Italy, Spain, etc. Many scientists as Forster, Persch, Duclaux and Hehner consider their use injurious to the human digestive organs.

It is evident that every endeavor should be made to prevent their use and that the law of Pennsylvania should strictly prohibit the sale of chemicals intended for such purposes, and the use of any chemicals whatsoever in milk should be considered an adulteration.

ECONOMIC USE OF ICE.

Many milk dealers use ice for the purpose of cooling their products. It is desirable to do this unless an abundant supply of cold spring water is to be optained for keeping the milk cool. Many of our Pennsylvania dealers use large quantities of ice, but apply it in such a manner as to cool the mik very inefficiently. On a large number of wagons cans of milk were on a cake of ice or surrounded by small pieces for a depth of four to eight inches, while the rest of the metallic can was fully exposed to the warm atmospheric air. A sufficient amount of ice was used to cool the entire amount of milk on the wagons efficiently, yet the milk was found to be warm. Much of the Reading

* Dairy Bacteriology by Russell.
† Lecture Notes from Dr. Conn.
‡ Dairy Bacteriology by Dr. Ed. Von Freudenreich.
§ Hutchinson's Thesis. State College, 1897.
|| Principles of Modern Dairy Practice—Grotenfelt—Woll.

milk delivered in wagons was handled in this way. In other cases a small can holding ice was placed in a larger can of milk, while the outer can was entirely unprotected from the warm atmospheric air. Many cans of this kind are carried on the Harrisburg wagons. In this case the amount of ice used produces its maximum cooling power on the milk, but a much larger surface of milk can is exposed to the warm air and these metal cans are rapid heat conductors, so that the milk is rapidly warmed from the external air on a warm day. The milk cans may be completely surrounded by ice. When this is not done, they should be surrounded by a wood jacket, constructed in such a manner as to leave a dead air space between the tin can and jacket, or a cover of close woven material such as is represented in figure 4. Blankets would be much better than nothing.

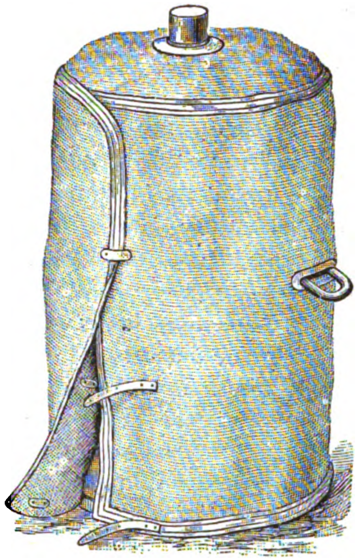


Fig. 4.

The contents of the can should be protected from the changes of the atmosphere while it is being delivered. These jackets are also useful when the weather is extremely cold.

In one case (in York) pieces of ice were carried in the milk. Most of the people understand that this is an adulteration concerning which the law is specific.

BOTTLED MILK.

In almost every city in Pennsylvania there is at least one milk dealer who supplies bottled milk. Samples 101, 118, 137, 138 (pasteurized), 271 (pasteurized), 330 and 342 are representatives of this class. The largest number of bacteria in any of these samples was 1,900,000 per cc. The average number, omitting the two samples that were pasteurized, was 523,900 per cc. The average number of bacteria in all of the wagon milk examined was 2,657,500, and of the depot milk 3,821,700 per cc.

Cans cannot be opened in a dusty street or store room without becoming more or less contaminated, and properly bottled milk is naturally more pure. When bottles are used, the milk should be put into them as soon as it is drawn, strained and cooled. They should then be sealed and kept in a cool place until ready for consumption. Bottling milk increases the expense considerably, but milk thus treated is much preferred to that handled in the usual way.

DELAYS IN MILK DELIVERY.

It is desirable that the condition in which consumers receive their milk should be as fresh as circumstances will permit. Experiments by Prof. Sedgwick* show conclusively that with ordinary refrigeration, sufficient to prevent the formation of acid, the number of bacteria present will increase rapidly and the keeping is imperfect from a sanitary point of view. In cities like New York and Philadelphia it is impossible to deliver all milk while it is new, but it seems as if much of it should be delivered sooner than it is. A great many of the milk trains arrive in Philadelphia in the morning between the hours of five and eight. The milk is taken to the milk depots several hours later and large quantities are kept until the next day, when it is delivered on wagons about 9 a. m.

The conditions in most of these depots are very good. In many cases the temperature of the milk was found to be below 40 degrees F., but, as Dr. Sedgwick's work shows, this does not stop the multiplication of all germs. Certainly the dealers should be able to retail their milk before it has been kept in the city from twenty to thirty hours. Milk transit should be rapid and the milk delivered while it is fresh.

CONTAMINATION OF MILK BY DISEASE GERMS.

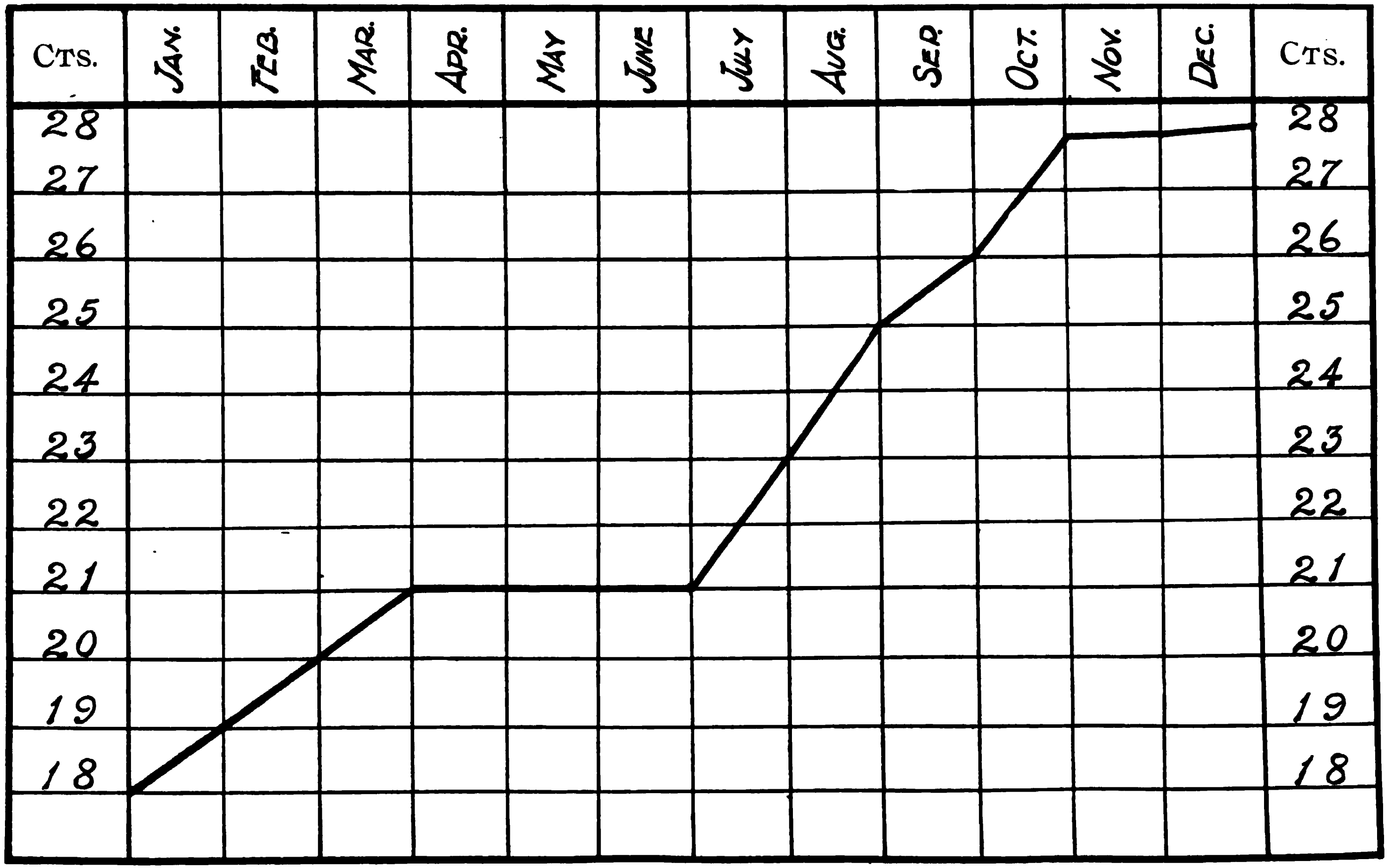
While it was impossible to actually detect any disease producing germs in the various samples of milk examined, on account of the lack of time and the necessary facilities, it seems best to devote a chapter to this question. The ordinary saprophytic organisms that are found in milk never produce any specific disease, and are injurious only when they produce some poisonous substance, such as tyrotoxicon, in the milk (see page 570), or in the ordinary alimentary canal after consumption.

Diseases common to man and animals may be transmitted from the latter to the former through the infection of milk before it is removed from the animal. Man may also become infected through pathogenic germs gaining access to the milk after it comes from the cow.

TUBERCULOSIS.

The most common disease communicated through milk to man is tuberculosis. The germ producing this disease in man is identical with the one producing it in cattle and other animals. When these germs occur in milk, they usually come directly from a diseased cow, although they may come from another source, such as the expectoration from diseased lungs, and get into the milk in the process of handling it. They usually get into the milk from an infected milk duct, and many authorities claim that they are also found in the milk of animals affected with general tuberculosis, but with apparently sound udders. There is ample proof that milk so infected may pro-

* Journal of the Mass. Ass'n Boards of Health.



PRICES OF WOOL AT PHILADELPHIA, 1897.

duce the disease. Milk may contain the bacilli in a virulent form without causing any trouble, for the reason that a considerable but varying number of germs is required to produce the disease. Nature also protects man. A certain predisposition is necessary in order that the specific germ may cause infection. When the system is in good condition, danger from this source is very much less than it would be were there some irritation of the mucous membrane or a weakness in some part of the constitution. Fortunately, the milk sold in the markets is usually the mixed product from a number of animals or even herds, so that when milk is affected with this bacillus it is usually diluted with good milk. The dilution makes the number of germs consumed by one person smaller, thus decreasing the chance for infection. Experiments made at Copenhagen show that dilution with pure milk diminishes, but does not remove, the danger. Fortunately for the human race, bacillus tuberculosis does not multiply in milk. The germs are very resistent to most of the ordinary destructive agencies. Light appears to be their greatest enemy. The work of Koch and others shows that direct sunlight destroys them in a few hours, or even minutes, and diffused light destroys them in four or five days. It is unfortunate that so many cattle must be closed up in dark, poorly-ventilated barns. If one animal becomes affected so as to throw off the germs in any way, everything in the barn may become infected, and then other animals contract the disease, simply because the sunlight had no chance to purify the surroundings. Another source of danger in some of the barns in which our best herds are kept is the manner in which the water is supplied. At the head of every animal is a place for water. The water is conducted from one trough to the next, so that the last cow in the row receives what every other cow has stood over and refused. Any germs that may get into the supply are carried on down the row, yet there is not an outflow sufficient to remove them for hours or days. The sunlight cannot remove the specific virus should it once gain admission to the water. Cannot our architect give us plans for a barn which will admit the sunlight and allow it to accomplish what nature intended it should? It is necessary for the animals to be out so that they may remain in health, but it is also necessary that they should be stalled in a lighted, ventilated place, where infection cannot remain.

Cows suffering from tuberculosis should be removed rrom the herd as a protection to man and the sound animals remaining. Even if infection is not often caused by milk, the nature of the disease and the fact that it can be so induced, makes it our duty to remove the possibility. In 1889 the Experiment Station herd was tested for tuberculosis, and all the animals responding to the test, three in number, were removed. The herd has been tested repeatedly since then and no cases have yet developed. Had the diseased animals remained, it is probable that many more would be infected now.

After the removal of animals responding to the tuberculin test, the danger from specific germs that may have been left by the diseased animals may be destroyed by disinfection.

To do this, remove all the animals from the barn and scrub every nook and corner with a solution of copperas (proto-sulphate of iron), using one pound of the disinfectant to a gallon of water. This will act as a deodorizer as well as a disinfectant. After disinfecting, in fact, at all times, a coat of whitewash on the walls and ceiling will prove beneficial in several ways. The development of germs is slightly checked for some time. The stable also becomes lighter and more cheerful—condition beneficial to the animals but injurious to all bacterial life. The writer is fully convinced that if tuberculous-free animals only are used for breeding purposes, and all diseased animals removed from the barns and herds, the chances of a healthy herd becoming infected are very slight. The tuberculin test makes the detection of tuberculous animals a very simple matter.

The danger of infection from pasteurized tuberculous milk is very slight. It is probable that all germs of this species are destroyed by pasteurization temperature. It is, however, much better to secure milk from a herd that is known to be free from tuberculosis. An excellent rule to follow is to pasteurize the milk in case of doubt, but never use it if an animal producing the supply is known to be diseased.

TYPHOID FEVER.

A number of cases of this disease have been traced directly to milk as the cause. The specific germ never develops in the animal, but gets into the milk only when it is improperly handled after removal from the cow. The milk may be directly affected from a convalescing patient or a nurse. Contamination may also arise from a polluted water supply. Unlike that of tuberculosis, the bacillius of typhoid fever rapidly multiplies in milk, so that a slight infection may become serious. Access of these germs to milk can easily be prevented by a little care.

No one who in any way comes in contact with the disease should handle milk. Water used for washing the milk vessels should be boiled if there is any possibility of its containing these prolific germs. Milk is such an excellent medium for their growth that a pailful of milk containing a few drops of polluted water may soon become more seriously affected than the water supply.

A case that might become a great danger to public health came to the notice of the writer while making an inspection. In Altoona, a large portion of the sewage is discharged into the Juniata creek, a small stream of water running almost parallel to the public road to Tyrone. The vile odors which emanate from this stream make the air foul for a distance of several hundred feet for some miles down the stream. The water in the stream is largely sewage in the dry season

and in many places the bottom of the creek is filled with the vilest kind of black mud, through which gases due to fermentation bubble. Several herds of cattle supplying city milk at times gain access to this stream. In one place fresh tracks six inches deep were seen in the bed of this stream and on the banks above was a herd of cattle with the teats, udders, legs, etc., covered with black, filthy dirt. A short distance below this was a single milk cow which evidently had access to the same stream. These cows could not possibly be brushed so thoroughly as to prevent the dropping of some dust particles into the milk pails and it is in this dust that the danger lies. Positive cases of a whole stream being infected from one typhoid fever patient are numerous. Milk from the cows above referred to could not be infected before removal from the udders. A few drops of the sewage water or a dust particle from the evaporation of such water could endanger the whole milk supply.

Months might elapse without the stream containing a single typhoid fever bacillus, but the sewage from one residence containing one typhoid fever patient is almost certain to inoculate the whole stream, and one infected milk supply is sufficient to cause many outbreaks.

Local officers should have the authority to prohibit the sale of milk from all herds having access to such places and the public should be warned of the exact danger lying in them. The chance of contamination of milk due to animals drinking such water is slight compared with that of direct external infection.

OTHER DISEASES.

A number of cases of diphtheria have been clearly traced to infected milk supplies. The specific germs of this disease gain access to and multiply in milk in the same manner as those of typhoid fever. There is probably not so great a danger through the water supply, but all precautions must be taken to prevent the admission of these germs.

It has been thoroughly proved that scarlet fever may be transmitted by milk* that has become contaminated after it has been drawn.

All milk coming from animals that are affected in any way or milk having an abnormal appearance, should be rejected for human food. The infection of the animal may not be common to man, but the possibility of danger is sufficient to make the use or sale of such milk a public offense. It is of equal or even greater importance that persons acting as nurses for the sick should not touch the milk supply. The specific organisms of a number of diseases, for instance, scarlet fever, have not been isolated, and so their exact relation to milk has not been studied, but it is known that some of these diseases have been transmitted through milk.

Too much care cannot be taken to keep milk free from infection that may prove harmful to the consumer.

* Dairy Bacteriology—Russell.

THE MILK CHEST AND CELLAR.

Milk is an absorbent of many bad odors, and from these it is frequently possible to tell what has been kept in the cellar or milk chest. By placing a sample of milk in a silo, a cellar where there is decayed vegetable matter, or a pig pen, and then heating to 110 degrees F., the characteristic odor of these places is very apparent. In a great many of the small retail stores inspected, the bottom of the milk chest was covered with decayed milk drippings, while meat and other food was someimes found in the milk chest. In a number of the small depots, dealers lived, slept and ate in the room where the milk chest was kept, and though this milk was often thoroughly cooled—as good as the average, from a chemical and bacteriological standpoint, the odors were offensive. These conditions were usually found in foreign settlements. The milk chest should be kept scrupulously clean and should not be used for other food. The work necessary to keep it clean may be very much diminished if drippings are prevented from falling into the chest, which can be done in several ways. A method used in several of the best depots consisted of a large, flat, tin funnel about fourteen inches in diameter, the neck fitting into the milk can in the same manner as a cover. Before removing any milk from a can the lid was replaced by this funnel, which was allowed to remain until all the milk was sold. This collected all drippings that necessarily resulted when customers were being served, allowing them to go back into the can. Such a funnel can be quickly washed and the floors will not become saturated with filthy drippings.

NUMBER OF BACTERIA IN MILK.

Since milk is sterile in the udder, a large number of bacteria in the supply signifies either lack of cleanliness or old milk. The work of different investigators shows that by taking precautions enumerated on page —, the access of germs to milk from external sources is only from 1-25 to 1-50 as great as when the milk is handled in the usual way, and that the rapidity of development in the milk depends on the temperature, being rapid between 75 degrees and 113 degrees F., and most rapid at about 90 degrees F.

The Pennsylvania supplies were studied at the hottest season of the year and the number of organisms found is probably greater than it would be at any other time. The average number found in all of the milk examined, which included all classes of milk, was over five and one-half millions per cc. Ten samples contained forty or more millions per cc., and ten other contained between twenty and forty millions per cc. These large numbers in a few samples make the total average very much higher than it should be. The worst samples were usually found at restaurants or with small retail dealers, so that such milk reaches fewer persons than that from the better supplies. Sev-

enty-seven samples, 28 per cent. of the samples tested, contained less than 100,000 bacteria per cc. About 34 per cent. contain less than 500,000 per cc., and 124 samples, corresponding to about 45 per cent., contain less than 1,000,000 per cc. In Williamsport, the weather was cold and rainy while the inspection was being made, and here the milk from all sources contained an average of 437,000 bacteria per cc., a number 1-13 as great as that obtained in all the Pennsylvania supplies, This comparatively low number is not entirely due to the weather. The municipal inspector, Dr. Richter, visits the dairies, compels the animals and barns to be kept clean and reports bad conditions to the public. Here the conditions are better than in any other city inspected, and there seems to be no doubt that this condition is partly due to the system of inspection, and all milk supplies will be very materially improved when the dairies are inspected as these in the vicinity of Williamsport are and all dealers who will not keep their herds and milk houses in a reasonably good condition are compelled to go into some other business.

In Philadelphia and New York the supply is remarkably good, especially when we consider the distance much of the milk must be shipped and the fact the city authorities are unable to inspect the herds, barns and milk houses.

The worst milk was found in Pittsburgh. The number of bacteria per cc. was four times as great as the average for all Pennsylvania, or of New York city and Philadelphia, yet the temperature was on an average six degrees lower while the investigation was made in Pittsburgh than it was in the two larger cities. Neither is the Pittsburgh milk shipped as great distances as that for the two other cities mentioned, and for this reason the milk supply should be materially better. The milk shipped to Philadelphia and New York is probably handled more carefully by the producer than that sent to Pittsburgh, and as a whole it is undoubtedly kept better after reaching the city than that of many other cities.

Before buying milk from dairies with which they are unacquainted a number of the wholesale dealers have herds examined to see that the animals are free from disease affecting the wholesomeness of the milk; they have the water and food supply examined; examine the cleanliness of the stables, milk room, cooler, cans, pails and other utensils, and ascertain regarding the freedom of employes from infectious or contagious diseases. They then handle the milk properly after receiving it at the depots.

Such an inspection should be made of all milk supplies, and in addition to this Pittsburgh, Allegheny, Altoona and Harrisburg are in especial need of such an inspection that will bring the milk to the chemical standard demanded by the law at the present time. The milk supply of Scranton, Erie, York and Reading is much better than

that of Pittsburg, Altoona, Allegheny and Harrisburg. While there is practically the same number of organisms in the milk of Altoona and Harrisburg as in that of Philadelphia and New York, the age of the milk received by the latter cities is considerably greater when received from the patrons, and the large number of organisms found in the fresh milk certainly shows a lack of cleanliness.

Dealers who make a study of their business take pains to treat their milk properly from the time of production to that of consumption, thereby always supplying a purer and more wholesome article of food than their neighbors, who, in many cases aim at one thing only, namely, that of preventing loss of milk by souring while in their possession.

The milk supply of cities which have a conscientious inspector continually at work, as is the case in Williamsport, New York, Philadelphia, Scranton and Erie, is much better than in such cities as Altoona, where there is practically no inspection.

The inspection of milk from the standpoint of filth is even more essential than that of determining its chemical purity as measured by its percentage of fat and total solids, and it seems that this is where the greatest reform should be made.

COMPOSITION OF THE PENNSYLVANIA MILK.

Of 342 samples tested for fat 64 (18.7 per cent.) were found to contain less than 3 per cent.; 41 of these were below 2.75 per cent.; 22 below 2.3 per cent.; 12 solids below 2.25 and 7 below 2 per cent.

Of 329 total solids determined 190 were below 12.9 per cent., 72 less than 11.5 per cent. and 37 less than 11 per cent.

The specific gravity of 18 out of 329 samples was below 1.029.

Of the 64 samples containing less than 3 per cent. of fat, all contained less than 12 per cent. total solids and 51 contained less than 11.5 per cent. Some of these samples were badly skimmed and some of them were watered. The restaurant milk, as a class, was badly adulterated, the average per cent. of total solids in all of the samples examined from this source (29) being only 11.33 per cent., and 13 of the samples were below 3 per cent. fat and 11.5 per cent. total solids. While 8 out of 30 contained preservatives (one was known to have been added at the milk depot), and from a bacteriological standpoint it was the worst milk examined. Restaurant milk is frequently skimmed and the cream used for various purposes.

Fifteen per cent. of the samples examined were undoubtedly watered or skimmed, and the results obtained on a number of other samples indicated that the supply was slightly adulterated. Assuming that 15 per cent. of all the samples was adulterated, it is probable much less of the total milk supply was adulterated for the reason that the dealers who sell large quantities of milk daily usually sell a good

quality of pure milk and adulteration is practiced mostly by those who sell only a few gallons daily. These small dealers supply a relatively small number of persons and handle a small percentage of the total milk supply.

Not only from a bacteriological standpoint, but also from the point of chemical purity it is apparent that rigid city inspection helps very much to diminish adulteration and to improve our our city milk supplies.

GLOSSARY OF SCIENTIFIC TERMS USED.

Aerobes.—Organisms requiring air or free oxygen for their growth.

Anaerobes.—Organisms not requiring air for their growth.

Albuminoids.—An important class of nitrogenous bodies formed by living matter. The casein of milk and the white of an egg are two common examples.

Bacilli.—The plural of bacillus. Small rod-shaped bacteria.

Cocci (singular coccus).—Spherical bacteria.

Colony.—The progeny of a single germ growing in an isolated medium.

Cubic centimetre.—A volume equal to 1-960 part of a quart.

Disinfect.—To purify by the destruction of germ life.

Disinfectant.—Any substance used to destroy bacteria or other germs.

Endospore.—A spore formed within a mother cell by a change in the nature of a portion of the protoplasm.

Facultative.—Organisms that grow under varied conditions.

Fission.—Division of a cell by direct partition.

Infection.—Contamination with disease producing or any other undesirable organisms.

Infectious.—Having power to pollute or taint.

Inoculation.—The act of introducing micro-organisms from one medium to another.

Lactic acid.—The sour principle that develops in milk by normal fermentation.

Medium.—The artificial preparation in which bacteria are grown for examination.

Micro-organisms.—Any microscopic form of life, more especially the general class of bacteria.

Microbe.—A microscopic organism.

Obligate.—Bacteria that require certain conditions in order to grow.

Parasitic.—Living organisms that derive their nourishment from living matter.

Pasteurization.—The destruction of germs by a temperature of from 140 to 165 degrees F.

Pathogenic.—Disease producing.

Preservaline.—A mixture of boracic acid or borates for retarding fermentation of milk or other foods.

Preservative.—Any chemical used to prevent fermentation.

Saprophytes.—Organisms subsisting on dead matter.

Spores.—The resisting stage of certain species of bacteria.

Sterile.—Free from all kinds of microscopic life.

Sterilizer.—The apparatus in which sterilization is accomplished.

Total solids.—All the ingredients in milk except the water.

Tuberculin.—A preparation from a culture of the germs of tuberculosis which is used to determine whether or not cattle are affected with that disease.

Tyrotoxicon.—A poisonous substance occasionally formed in milk or cheese by the action of bacteria.

Vegetating.—Growing. Germs not in spore condition.

APPENDIX.

In the Appendix all actual results obtained while making the investigation are given. In the classification, all samples selected at places retailing milk only are placed under "milk depots," but when milk and other things are offered for sale at the same place, the place is spoken of as a "variety store." In samples 1 to 176, inclusive, some of the places of selection referred to as milk depots should probably be called variety stores on account of the sale of other things, which were not noted at the time.—

Samples 1 to 36, inclusive were selected in Philadelphia.
Samples 37 to 70, inclusive, were selected in Reading.
Samples 71 to 101, inclusive, were selected in Harrisburg.
Samples 102 to 133, inclusive, were selected in York.
Samples 134 to 176, inclusive, were selected in Altoona.
Samples 177 to 229, inclusive, were selected in Pittsburgh.
Samples 230 to 246, inclusive, were selected in Allegheny.
Samples 247 to 277, inclusive, were selected in Erie.
Samples 278 to 304, inclusive, were selected in Scranton.
Samples 305 to 330, inclusive, were selected in New York.
Samples 331 to 352, inclusive, were selected in Williamsport.

TABLE No. I.

Number.	Place of Selection.	Per cent. of fat.	Specific gravity.	Total solids.	Number of bacteria, per cc.	Number of liquifying bacteria, per cc.	Acidity.	Temperature on Days of Selection. Maximum (degrees).	Minimum (degrees).	Mean (degrees).	Remarks.
	Philadelphia.										
1	Restaurant,	....	....	....	....	....	....	88	67	78	Not tested.
2	Restaurant,	4.60	1.0298	12.98	6,100,000	....	.18	90	71	80	Later a bad taste developed.
3	Restaurant,	3.90	....	....	2,795,100	6,600	.19	90	71	80	
4	Restaurant,	2.25	1.0286	9.98	1,520,000	20,000	.15	90	71	80	Ice in milk.
5	Restaurant,	2.70	1.0314	11.28	15,019,000	115,000	.19	90	71	80	
6	Railroad station,	2.95	1.0320	11.92	700,000	10,000	.14	77	62	70	
7	Railroad station,	3.40	1.0330	12.47	39,500	15,000	.16	77	62	70	
8	Railroad station,	7.00	1.0250	14.80	3,077,500	1,000	.16	77	62	70	
9	Railroad station,	3.75	1.0303	12.20	3,125,000	5,000	.17	77	62	70	
10	Railroad station,	3.50	1.0310	12.09	141,750	....	.18	77	62	70	
11	Railroad station,	4.30	1.0312	13.10	80,000	20,000	.17	77	62	70	
12	Railroad station,	4.70	1.0340	14.28	3,700,000	350,000	.15	77	62	70	
13	Railroad station,	3.40	1.0309	11.95	870,000	....	.18	77	62	70	
14	Milk depot,	4.60	1.0340	14.16	7,500,000	....	.19	81	61	71	
15	Milk depot,	4.60	1.0322	13.71	3,090,000	50,000	.18	81	61	71	
16	Milk depot,	3.70	1.0290	11.83	7,750,000	10,000	.18	81	61	71	
17	Milk depot,	3.30	1.0315	11.98	6,750,000	130,000	.19	81	61	71	
18	Milk depot,	4.00	1.0333	13.27	1,710,000	35,000	.18	81	61	71	
19	Milk depot,	3.05	1.0287	10.97	2,160,000	80,000	.15	81	61	71	
20	Milk depot,	4.40	1.0275	12.30	2,880,000	....	.16	81	61	71	
21	Milk depot,	5.10	1.0318	14.10	4,000,000	....	.17	81	61	71	
22	Milk depot,	3.20	1.0317	11.90	....	....	.18	81	61	71	
23	Variety store,	7.80	1.0277	16.02	....	....	.16	84	65	74	
24	Variety store,	4.30	1.0347	13.98	....	....	.18	84	65	74	
25	Variety store,	3.50	1.0337	12.77	2,390,000	45,000	.19	84	65	74	
26	Milk depot,	4.30	1.0335	13.68	....	....	.17	84	65	74	Gaseous fermentation.
27	Variety store,	2.80	1.0308	11.20	....	....	.18	84	65	74	
28	Variety store,	2.75	1.0317	11.36	....	....	.18	84	65	74	
29	Milk depot,	3.60	1.0336	12.86	....	....	.16	84	65	74	
30	Restaurant,	4.30	1.0342	13.85	....	....	.18	91	73	82	
31	Wagon,	3.20	1.0327	12.16	6,250,000	20,000	.19	91	73	82	
32	Wagon,	3.45	1.0311	12.05	1,000,000	40,000	.19	91	73	82	
33	Wagon,	4.00	1.0302	12.49	240,000	40,000	.18	91	73	82	
34	Restaurant,	2.70	1.0294	10.73	40,000,000	....	.27	91	73	82	Borax found.

Table No. I—Continued.

Number.	Place of Selection.	Per cent. of fat.	Specific gravity.	Total solids.	Number of bacteria, per cc.	Number of liquifying bacteria, per cc.	Acidity.	Temperature on Days of Selection. Maximum (degrees).	Minimum (degrees).	Mean (degrees).	Remarks.
35	Wagon,	3.70	1.0317	12.51	220,000	5,000	.17	91	73	82	
36	Milk depot,	4.00	1.0304	12.54	....	....	.17	91	73	82	
	Reading.										
37	Restaurant,	....	....	....	1,750,000	40,000	.12	....	....	80	Soda found.
38	Wagon,	3.60	1.0352	12.78	1,950,000	50,000	.17	....	....	80	Morning's milk.
39	Wagon,	3.10	1.0294	11.22	170,0[illegible]0	10,000	.15	....	....	80	Morning's milk.
40	Wagon,	3.10	1.0307	11.51	200,000	2,500	.15	....	....	80	Milk about four hours old.
41	Wagon,	6.50	1.0282	14.99	10,800,000	7,500	.17	....	....	80	Morning's milk.
42	Wagon,	3.[illegible]0	1.0312	11.66	395,000	13,000	.15	....	....	83	Morning's milk.
43	Restaurant,	6.40	1.0280	14.83	445,000	14,000	.17	....	....	83	
44	....	....	....	....	....	....	....	....	....	83	Sample lost.
45	Wagon,	3.80	1.0333	13.03	311,500	9,000	.16	....	....	83	Morning's milk.
46	Wagon,	3.65	1.0324	12.62	405,000	8,500	.16	....	....	83	Morning's milk.
47	Restaurant,	2.75	....	....	3,450,000	25,000	....	....	....	83	
48	Milk depot,	2.90	1.0266	10.27	1,445,000	30,000	.15	....	....	81	Mixed night's and morning's.
49	Milk depot,	3.10	1.0307	11.54	226,500	750	.19	....	....	81	Mixed night's and morning's.
50	Milk depot,	4.00	1.0306	12.59	1,810,000	500	.19	....	....	81	Mixed night's and morning's.
51	Milk depot,	3.55	1.0309	12.12	505,000	40,000	.18	....	....	81	Mixed night's and morning's.
52	Milk depot,	3.60	1.0325	12.59	2,250	1,000	.20	....	....	81	Mixed night's and morning's.
53	Milk depot,	4.70	1.0312	13.58	710,000	6,000	.20	....	....	81	Mixed night's and morning's.
54	Milk depot,	3.60	1.0309	11.59	400,000	5,000	.19	....	....	81	Mixed night's and morning's.
55	Milk depot,	0.50	....	....	....	....	....	....	....	81	Separator skim milk.
56	Milk depot,	3.80	1.0311	12.48	48,000	909	.20	....	....	81	Mixed night's and morning's.
57	Milk depot,	3.50	1.0314	12.19	....	....	....	....	....	81	
58	Milk depot,	4.40	1.0291	12.70	....	....	....	....	....	81	
59	Milk depot,	4.05	1.0295	12.37	....	....	....	....	....	81	
60	Milk depot,	3.30	1.0284	10.20	....	....	....	....	....	81	
61	Milk depot,	3.55	1.0312	12.19	....	....	....	....	....	81	
62	Milk depot,	3.80	1.0319	12.68	....	....	....	....	....	81	
63	Wagon,	3.60	1.0329	12.69	1,935,000	205,000	.20	....	....	88	Morning's milk.
64	Wagon,	3.15	1.0296	11.31	1,260,000	115,000	.18	....	....	88	
65	Wagon,	3.60	1.0314	11.71	149,250	7,500	.20	....	....	88	Morning's milk.
66	Wagon,	3.30	1.0311	11.88	58,250	500	.20	....	....	88	Morning's milk.
67	Milk depot,	3.80	1.0301	12.23	239,250	11,750	.20	....	....	88	Morning's milk.

68	Milk depot,	3.60	1.0288	11.41	14,300,000	400,000	.20			88	Morning's milk.
69	Milk depot,	0.30								88	Separator skim milk
70	Milk depot,	0.25								88	Separator skim milk.
	Harrisburg.										
71	Wagon,	2.50	1.0350	11.89	790,500	39,925	.18	84	68	76	Milk about two hours old.
72	Wagon,	3.20	1.0235	9.86	1,162,500	28,750	.20	84	68	76	Milk about two hours old.
73	Wagon,	3.10	1.0326	11.99	3,940,000	600,000	.19	84	68	76	Milk about two hours old.
74	Wagon,	2.40	1.0345	11.65	349,500	8,000	.19	84	68	76	Milk about two hours old.
75	Wagon,	2.90	1.0326	11.77	1,177,500	1,500	.19	84	68	76	Morning's milk.
76	Wagon,	4.05	1.0328	12.94	930,000	3,000	.20	84	68	76	Morning's milk.
77	Wagon,	3.60	1.0309	12.19	114,250		.17	84	68	76	Morning's milk.
78	Wagon,	3.70	1.0306	12.23	775,000	3,500	.17	81	67	74	Morning's milk (warm).
79	Wagon,	3.40	1.0319	12.20	119,000	12,000	.17	81	67	74	Morning's milk (warm).
80	Wagon,	3.00	1.0306	11.39	617,500	34,500	.17	81	67	74	Morning's milk (warm).
81	Wagon,	3.00	1.0327	11.91	367,500	1,150	.17	81	67	74	Morning's milk (warm).
82	Wagon,	3.10	1.0302	11.41	3,750,000	7,500	.21	81	67	74	Last night's milk (ice used).
83	Wagon,	1.50	1.0319	9.94	35,000,000	25,000	.21	81	67	74	Morning's milk (warm).
84	Wagon,	2.75	1.0300	10.93	2,172,000	12,000	.18	81	67	74	Morning's milk (warm).
85	Wagon,	3.70	1.0296	11.96	8,300,000	15,000	.18	81	67	74	Morning's milk (warm).
86	Wagon,	3.40	1.0316	12.12	1,075,000	135,000	.17	81	67	74	
87	Railroad station,	5.20	1.0308	13.97	775,500	2,500	.20	85	61	73	
88	Railroad station,	4.40	1.0300	12.92			.20	85	61	73	
89	Railroad station,	4.70	1.0306	13.43	62,500	7,500	.20	85	61	73	
90	Railroad station,	4.10	1.0296	12.46			.20	85	61	73	
91	Railroad station,	5.10	1.0312	13.94	1,950,000	2,500	.20	85	61	73	
92	Restaurant,	5.10	1.0302	13.82	7,780,000	10,000	.20	85	61	73	
93	Restaurant,	3.20	1.0312	11.53	510,000	70,000	.19	85	61	73	
94	Restaurant,	2.00	1.0327	10.72	7,500,000	58,500	.22	86	61	74	Milk very cold.
95	Milk depot, (?)	2.65	1.0329	11.53	24,000,000		.19	86	61	74	Ice in warm milk.
96	Milk depot, (?)	2.60	1.0332	11.56	25,000,000		.30	86	61	74	
97	Milk depot,	3.20	1.0326	12.13	875,000	60,000	.18	86	61	74	Borax.
98	Milk depot,	2.40	1.0346	11.67	202,500	10,000		86	61	74	
99	Milk depot, (?)	3.10	1.0320	11.86	3,490,000	120,000		86	61	74	Morning's milk.
100	Milk depot,	3.10	1.0341	12.39	1,170,000	12,000		86	61	74	
101	Milk depot,	4.10	1.0330	13.19	485,000	1,000		86	61	74	Bottled milk, eighteen hours old, well cooled.
	York.										
102	Milk depot,	5.60	1.0310	14.62	14,700,000	30,000	.20	83	68	76	Purchased by a boy.
103	Milk depot,	3.85	1.0253	11.08	7,000,000	35,000	.19	83	68	76	Purchased by a boy.
104	Milk depot,	3.90	1.0243	10.89	675,000	35,000	.17	83	68	76	Purchased by a boy.
105	Milk depot,	3.90	1.0309	12.55	1,480,000	40,000	.17	83	68	76	Purchased by a boy.
106	Milk depot,	3.60	1.0243	10.54	639,000	6,000	.17	83	68	76	Purchased by a boy.
107	Milk depot,	4.00	1.0332	13.24	51,300	29,700	.18	83	68	76	Purchased by a boy.
108	Milk depot,	2.75	1.0333	11.81	4,350,000	15,000	.18	83	68	76	Purchased by a boy.
109	Milk depot,	3.30	1.0306	11.75	240,000	35,000	.17	83	68	76	Purchased by a boy.
110	Wagon,	4.50	1.0330	13.79	1,205,000	325,000	.19	89	70	80	Purchased by a boy.
111	Wagon,	3.30	1.0330	12.35	19,275,000	375,000	.21	89	70	80	
112	Wagon,	3.05	1.0305	11.42	640,000	100,000	.18	89	70	80	
113	Wagon,	5.70	1.0305	14.62	7,387,500	100,000	.19	89	70	80	
114	Wagon,	3.20	1.0300	11.48	7,500,000	162,000	.17	89	70	80	Some odor.
115	Wagon,	2.90	1.0335	12.00	1,069,200	45,900	.18	89	70	80	Morning's milk.
116	Wagon,	4.50	1.0291	12.82	75,000	15,000	.17	89	70	80	Morning's milk.

Table No. 1—Continued.

Number.	Place of Selection.	Per cent of fat.	Specific gravity.	Total solids.	Number of bacteria, per cc.	Number of liquifying bacteria, per cc.	Acidity.	Temperature on Days of Selection. Maximum (degrees).	Minimum (degrees).	Mean (degrees).	Remarks.
117	Wagon,	6.10	1.0309	15.22	715,000	65,000	.19	89	70	80	Morning's milk.
118	Milk depot,	4.50	1.0314	13.39	580,000	55,000	.17	90	68	79	Bottled milk.
119	Wagon,	3.00	1.0325	11.87	120,000	10,000	.19	90	68	79	
120	Wagon,	4.10	1.0301	12.59	80,000	15,000	.17	90	68	79	Morning's milk.
121	Wagon,	3.65	1.0311	12.29	40,000	6,000	.18	90	68	79	Morning's milk.
122	Wagon,	4.00	1.0315	12.82	....	Many	.18	90	68	79	Sold several times.
123	Wagon,	3.60	1.0317	13.39	46,440	1,080	.18	90	68	79	Morning's milk.
124	Wagon,	4.75	1.0308	13.41	30,000	15,000	.17	90	68	79	Morning's milk.
125	Milk depot,	11.60	1.1012	39.76	3,000	2,500	.75	90	68	79	Fresh condensed milk.
126	Wagon,	4.10	1.0315	12.84	115,000	10,000	.18	85	62	74	Morning's milk, sold twice.
127	Wagon,	3.40	1.0314	12.07	432,500	15,000	.18	85	62	74	Last night's milk. Sold twice.
128	Wagon,	2.90	1.0309	11.35	690,000	25,000	.18	85	62	74	Mixed milk.
129	Wagon,	3.00	1.0334	12.09	72,000	....	.20	85	62	74	Last night's milk.
130	Wagon,	2.50	1.0322	11.19	No. very large.	No. very large.	.18	85	62	74	Last night's milk.
131	Wagon,	3.80	1.0338	13.15	No. very large.	No. very large.	.20	85	62	74	Some odor.
132	Wagon,	3.00	1.0313	11.56	28,070	9,000	.18	85	62	74	Last night's milk. (?)
133	Wagon,	3.50	1.0313	12.16	....	....	.18	85	62	74	Morning's milk.
	Altoona.										
134	Wagon,	4.45	1.0296	12.88	9,925,000	795,000	.17	76	61	68	Probably last night's milk.
135	Wagon,	3.00	1.0299	11.21	8,640,000	460,000	.17	76	61	68	Churned. Analysis not used.
136	Restaurant,	1.90	1.0323	10.50	10,780,000	425,000	.17	76	61	68	Bottled and cooled after shipping.
137	Milk depot,	2.60	1.0296	10.66	1,900,000	660,000	.17	76	61	68	
138	Milk depot,	2.30	1.0305	10.53	5,150,000	215,000	.18	76	61	68	Kept in dirty ice chest.
139	Restaurant,	2.50	1.0322	11.19	3,750,000	1,200	.23	76	61	68	Sour.
140	Restaurant,	2.20	1.0294	10.13	13,790,000	2,200,000	.15	76	61	68	Soda found.
141	Milk depot,	2.70	1.0308	11.08	12,360,000	45,000	.19	76	61	68	
142	Wagon,	3.40	1.0308	11.92	35,000,000	1,500	.23	74	55	64	Sour. Last night's milk.
143	Wagon,	3.20	1.0309	11.71	10,490,000	185,000	.20	74	55	64	Morning's milk (warm).
144	Wagon,	3.70	1.0308	12.28	5,370,000	45,000	.20	74	55	64	Last night's milk.
145	Wagon,	3.10	1.0276	10.76	865,000	136,000	.19	74	55	64	Last night's milk.
146	Wagon,	3.60	1.0296	11.86	1,180,500	40,000	.20	74	55	64	
147	Wagon,	3.80	1.0212	10.00	35,000	6,500	.19	74	55	64	Warm morning's milk.
148	Wagon,	2.55	1.0295	10.62	505,000	125,000	.19	74	55	64	Warm morning's milk.

149	Wagon,	3.60	1.0299	11.94	229,000	10,000		.74	55	64	Morning's milk.
150	Wagon,	[illegible]	1.0306	[illegible]	200,000	55,000	.18	85	58	72	Morning's milk.
151	Wagon,	4.90	1.0304	13.62	5,750,000	88,500	.18	85	58	72	Last night's milk.
152	Wagon,	3.10	1.0323	11.94	335,000	75,000	.20	85	58	72	Morning's milk (warm).
153	Wagon,	3.40	1.0304	11.82	37,500	3,000	.17	85	58	72	Morning's milk (warm).
154	Wagon,	2.80	1.0313	11.33	8,750	750	.18	85	58	72	Morning's milk (warm).
155	Wagon,	3.10	1.0265	10.49	18,750	1,500	.17	85	58	72	
156	Wagon,	3.00	1.0337	11.91	405,000	130,000	.20	85	58	72	
157	Wagon,	2.85	1.0326	11.70	132,000		.19	85	58	72	
158	Milk depot,	6.00	1.0279	14.33	7,090,000	410,000	.19	85	58	72	Sampled by Dr. Long.
159	Milk depot,	4.30	1.0296	12.58	2,570,000	520,000	.20	85	58	72	Sampled by Dr. Long.
160	Railroad station,	4.40	1.0305	13.05	31,500			86	60	73	Morning's milk.
161	Railroad station,	3.60	1.0312	12.26	275,000	45,000		86	60	73	
162	Railroad station,	3.40	1.0310	11.97	205,000	25,000		86	60	73	
163	Railroad station,	4.20	1.0291	12.46	6,140,000	450,000		86	60	73	
164	Milk depot,	4.50	1.0300	13.04	15,000,000	410,0.0	.19	86	60	73	Sampled by Dr. Long.
165	Milk depot,	4.15			30,000,000		.45	86	60	73	Sampled by Dr. Long (sour).
166	Restaurant,	3.20	1.0303	11.56	7,500,000						
167	Milk depot,	3.60									
168	Milk depot,	4.20									
169	Milk depot,	4.00									
170	Milk depot,	3.40									
171	Milk depot,	3.40									
172	Milk depot,	3.60									
173	Milk depot,	3.00									
174	Milk depot,	3.40									
175	Milk depot,	4.10	1.0300	12.56							
176	Restaurant,										Soda found.
	Pittsburgh.										
177	Restaurant,	2.00	1.0340	11.04	18,750,000	1,875,000		80	59	70	Soda found (bitter taste).
178	Restaurant,	2.25	1.0289	9.81	44,800,000	2,500,000		80	59	70	Ice in milk.
179	Restaurant,	4.10	1.0310	12.71	2,500,000	212,500		80	59	70	
180	Restaurant,	6.10	1.0297	14.90	2,787,500	100,000		80	59	70	
181	Restaurant,	3.10	1.0302	11.41	Very l'ge.	100,000		80	59	70	
182	Restaurant.	0.90	1.0330	9.47	22,500,000	250,000		80	59	70	
183	Wagon,	3.90	1.0310	12.57	60,000	10,000	.135	83	63	73	Pasteurized and bottled.
184	Milk depot,	1.90	1.0323	10.50	7,800,000	100,000	.185	83	63	73	Meat, etc., in milk chest.
185	Milk depot,	3.05	1.0301	11.32	7,700,000	337,500	.185	83	63	73	Retail can on counter.
186	Milk depot,	1.30	1.0335	10.08	41,125,000	37,500	.23	83	63	73	Retail can on counter.
187	Milk depot,	3.20	1.0314	11.83	36,350,000	1,337,500	.23	83	63	73	
188	Milk depot,	3.10	1.0289	10.97	800,000	125,000	.18	83	63	73	
189	Restaurant,	1.50	1.0275	8.82	50,000,000		.22	83	63	73	Small amount of soda found.
190	Milk depot,	2.35	1.0324	11.01	7,775,000	262,500	.19	85	66	76	
191	Variety store,	2.40	1.0324	11.04	21,625,000	62,500	.22	85	66	76	Very bad odor.
192	Variety store,	3.00	1.0333	11.93	2,525,000	400,000	.23	85	66	76	Dirty milk chest.
193	Variety store,	3.10	1.0330	12.11	41,250,000	1,125,000	.20	85	66	76	No ice used.
194	Variety store,	3.35	1.0340	12.65	3,200,000	367,500	.22	85	66	76	
195	Variety store,	3.60	1.0310	12.21	44,700,000	1,150,000	.31	85	66	76	
196	Wagon,	2.85	1.0315	11.44			.20	85	66	76	
197	Milk depot,	2.30	1.0325	11.08			.21	85	66	76	
198	Wagon,	3.15	1.0323	11.97			.18	85	66	76	
199	Variety store,	3.00	1.0308	11.44			.18	85	66	76	
200	Variety store,	3.70	1.0330	12.80			.22	85	66	76	

Table No. I—Continued.

Number.	Place of Selection.	Per cent. of fat.	Specific gravity.	Total solids.	Number of bacteria, per cc.	Number of liquifying bacteria, per cc.	Acidity.	Temperature on Days of Selection. Maximum (degrees).	Minimum (degrees).	Mean (degrees).	Remarks.
201	Wagon,	3.00	1.0328	11.94	....	....	.20	85	66	76	
202	Milk depot,	3.30	1.0328	12.30	....	....	.24	85	66	76	
203	Milk depot,	2.60	1.0329	11.49	....	....	.17	85	66	76	
204	Variety store,	4.00	1.0324	13.04	....	....	.20	85	66	76	
205	Variety store,	2.50	1.0312	10.94	....	....	.38	85	66	76	
206	Variety store,	2.70	1.0316	11.28	....	....	.21	85	66	76	
207	Wagon,	2.95	1.0326	11.82	....	....	.18	85	66	76	
208	Milk depot,	4.60	1.0310	13.41	....	....	.19	85	66	76	
209	Variety store,	3.15	1.0309	11.64	....	....	.24	85	66	76	Boracic acid found.
210	Milk depot,	4.40	1.0343	14.07	....	....	.22	85	66	76	
211	Railroad station,	3.50	1.0300	11.84	180,000	15,000	.17	76	64	70	
212	Railroad station,	3.25	1.0310	11.78	4,185,000	45,000	.17	76	64	70	
213	Railroad station,	3.90	1.0323	12.90	....	....	.22	76	64	70	
214	Railroad station,	3.50	1.0305	11.97	1,240,000	700,000	.20	76	64	70	
215	Railroad station,	4.50	1.0309	13.26	9,400,000	315,000	.21	76	64	70	
216	Railroad station,	3.30	1.0326	12.25	540,000	40,000	.22	76	64	70	
217	Railroad station,	4.80	1.0334	14.25	3,440,000	33,500	.20	76	64	70	
218	Railroad station,	2.90	1.0300	11.12	6,700,000	140,000	.20	76	64	70	
219	Railroad station,	3.70	1.0334	12.93	....	....	.17	76	64	70	
220	Milk depot,	3.40	1.0348	12.92	44,665,000	875,000	.24	76	60	68	Boracic acid found.
221	Milk depot,	2.10	1.0331	10.94	22,000,000	1,060,000	.19	76	60	68	
222	Milk depot,	2.00	1.0330	10.79	45,000,000	212,500	.27	76	60	68	
223	Milk depot,	2.60	1.0315	11.14	13,300,000	12,500	.19	76	60	68	
224	Milk depot,	2.6	1.0322	11.36	16,200,000	237,500	.20	76	60	68	Milk contained black dirt.
225	Milk depot,	3.10	1.0347	12.54	2,550,000	770,000	.20	76	60	68	Visible dirt particles.
226	Milk depot,	3.40	1.0312	12.02	....	....	.14	76	60	68	Pasteurized and bottled.
227	Milk depot,	3.30	1.0317	12.03	....	....	.17	76	60	68	
228	Milk depot,	....	....	....	....	....	....	....	....	....	Not tested.
229	Milk depot,	6.60	....	....	....	....	....	....	....	....	Not tested.
	Allegheny.										
230	Milk depot,	3.10	1.0332	12.16	2,825,000	262,500	.20	72	60	66	
231	Milk depot,	2.00	1.0331	10.82	3,225,000	201,000	.20	72	60	66	
232	Milk depot,	2.20	1.0301	10.31	350,000	200,000	.19	72	60	66	
233	Milk depot,	3.20	1.0326	12.11	10,000,000	V'y many	.19	72	60	66	
234	Wagon,	2.95	1.0327	11.85	2,025,000	202,500	.20	72	60	66	

235	Milk depot,	3.60	1.0301	11.99	1,110,000	50,000	.16	72	60	66	
236	Variety store,	3.20	1.0293	11.30	60,500	No. large.	.15	72	60	66	
237	Variety store,	3.60	1.0295	11.84	1,912,500	250,000	.16	72	60	66	Many alkaline putrefactive-bacteria.
238	Variety store,	3.10	1.0323	11.81	No. l'ge.	No. l'ge.	.20	72	60	66	
239	Wagon,	2.05	1.0335	10.92	No. l'ge.	No. l ge.	.18	72	60	66	
240	Wagon,	2.65	1.0330	11.56	....	....	.18	72	60	66	
241	Restaurant,	2.60	1.0330	11.51	26,875,000	637,500	.24	75	58	66	
242	Restaurant,	3.80	1.0294	12.05	1,670,000	80,000	.16	75	58	66	
243	Restaurant,	2.30	1.0260	9.40	26,250,000	750,000	.16	75	58	66	
244	Restaurant,	2.10	1.0307	10.34	625,000	15,000	.16	75	58	66	
245	Restaurant,	.90	1.0307	8.90	21,300,000	112,500	.27	75	58	66	Much borax.
246	Restaurant,	3.90	1.0342	13.37	18,000,000	177,500	.20	75	58	66	
	Erie.										
247	Milk depot,	3.65	1.0330	12.76	1,140,000	35,000	.17	67	58	62	
248	Wagon,	5.00	1.0292	14.44	85,000	5,000	.16	67	58	62	Morning's milk.
249	Wagon,	4.30	1.0311	13.08	8,500,000	59,000	.17	67	58	62	Morning's milk.
250	Wagon,	6.20	1.0299	15.07	985,000	No. l'ge.	.17	67	58	62	Morning's milk.
251	Wagon,	3.40	1.0309	11.95	90,000	20,000	.17	67	58	62	Morning's milk.
252	Wagon,	3.90	1.0330	13.07	83,500	5,000	.17	67	58	62	Morning's milk.
253	Wagon,	3.65	1.0309	12.49	....	60,000	.17	67	58	62	Morning's milk.
254	Wagon,	4.20	1.0293	12.51	....	....	.16	67	58	62	Morning's milk.
255	Wagon,	4.00	1.0331	13.22	40,000	500	.19	73	59	66	Last night's milk.
256	Wagon,	3.45	1.0314	12.12	30,000	2,000	.19	73	59	66	Last night's milk.
257	Wagon,	3.85	1.0310	12.50	55,000	4,000	.19	73	59	66	Last night's milk.
258	Wagon,	4.20	1.0315	13.06	53,000	7,000	.18	73	59	66	Morning's milk.
259	Wagon,	3.15	1.0264	10.51	46,500,000	60,000	.16	73	59	66	Last night's milk.
260	Wagon,	4.10	1.0310	12.71	....	....	.16	73	59	66	
261	Wagon,	3.30	1.0315	11.98	925,000	400,000	.16	73	59	66	Last night's milk.
262	Wagon,	4.80	1.0334	14.25	336,000	30,000	.20	73	59	66	Last night's milk.
263	Variety store,	3.55	1.0351	13.17	7,325,000	1,775,000	.21	68	60	64	Yesterday's supply.
264	Variety store,	4.30	1.0297	12.73	6,000,000	500,000	.16	68	60	64	Yesterday's supply.
265	Variety store,	5.10	1.0302	14.32	....	....	.19	68	60	64	
266	Milk depot,	4.00	1.0332	13.34	95,000	....	.21	68	60	64	
267	Milk depot,	4.40	1.0300	12.92	29,500	6,000	.18	68	60	64	
268	Milk depot,	4.20	1.0318	13.13	615,000	25,000	.18	68	60	64	
269	Milk depot,	3.50	1.0320	12.34	180,000	30,000	.21	68	60	64	
270	Milk depot,	4.20	1.0297	12.61	297,000	24,000	.18	68	60	64	
271	Milk depot,	3.55	1.0290	11.64	49,750	2,000	.17	68	60	64	Bottled "sterilized."
272	Wagon,	3.90	1.0335	13.20	45,000	25,000	.21	69	53	61	Morning's milk.
273	Variety store,	2.60	1.0334	11.61	42,500,000	44,000	.36	69	53	61	Dirty store.
274	Variety store,	3.70	1.0337	12.98	79,500	8,500	.19	69	53	61	
275	Wagon,	4.00	1.0293	12.27	295,000	10,000	.18	69	53	61	
276	Variety store,	3.60	1.0325	12.59	310,000	50,000	.20	69	53	61	Meat, etc., in chest. Bad odor.
277	Variety store,	3.30	1.0300	11.60	45,000	5,000	.18	69	53	61	
	Scranton.										
278	Variety store,	3.75	1.0320	12.63	120,000	5,000	.16	83	51	67	
279	Milk depot,	5.15	1.0305	14.48	5,000,000	No. l'ge.	.16	83	51	67	Yesterday's supply.
280	Milk depot,	5.20	1.0320	14.39	230,000	25,000	.16	83	51	67	
281	Variety store,	4.70	1.0322	13.83	No. l'ge.	....	.17	83	51	67	
282	Variety store,	4.05	1.0321	13.02	6,190,000	40,000	.18	83	51	67	Yesterday's supply.
283	Variety store,	3.90	1.0296	12.22	1,655,000	65,000	.16	83	51	67	Temperature of milk, 55 degrees Fahrenheit.

Table No. I—Continued.

Number.	Place of Selection.	Per cent of fat.	Specific gravity.	Total solids.	Number of bacteria, per cc.	Number of liquifying bacteria, per cc.	Acidity.	Temperature on Days of Selection. Maximum (degrees).	Minimum (degrees).	Mean (degrees).	Remarks.
284	Variety store,	4.10	1.0310	12.69	1,542,000	33,000	.16	83	51	67	
285	Variety store,	3.60	1.0322	12.51	....	....	.18	83	51	67	
286	Wagon,	4.50	1.0255	11.91	6,050,000	212,500	.13	72	50	61	Milk contained much dirt.
287	Variety store,	4.10	1.0321	12.97	3,850,000	100,000	.17	72	50	61	
288	Variety store,	3.70	1.0318	12.53	8,040,000	275,000	.16	72	50	61	
289	Variety store,	3.70	1.0299	12.05	260,000	25,000	.14	72	50	61	
290	Milk depot,	3.60	1.0317	12.38	3,570,000	90,000	.16	72	50	61	
291	Milk depot,	3.60	1.0275	11.34	2,920,000	20,000	.16	72	50	61	Unclean, cellar. Bad odor.
292	Wagon,	3.40	1.0317	12.14	55,000	5,000	.16	72	50	61	
293	Wagon,	3.65	1.0320	12.51	160,000	20,000	.16	72	50	61	Bottled milk.
294	Milk depot,	4.20	1.0315	13.06	....	....	.17	72	50	61	
295	Wagon,	4.50	1.0297	12.96	....	....	.16	72	50	61	
296	Wagon,	4.70	1.0305	13.41	1,025,000	15,000	....	78	43	60	
297	Milk depot,	4.30	1.0296	12.70	2,316,000	260,000	....	78	43	60	
298	Milk depot,	3.20	1.0293	11.31	400,000	No. l'ge.	....	78	43	60	
299	Variety store,	3.30	1.0280	10.10	360,000	65,000	....	78	43	60	
300	Variety store,	4.55	1.0325	13.74	465,000	40,000	....	78	43	60	
301	Milk depot,	4.05	1.0309	12.66	770,000	25,000	....	78	43	60	
302	Variety store,	4.65	1.0320	13.71	21,500,000	15,000,000	....	78	43	60	Milk about forty-eight hours old
303	Restaurant,	3.20	1.0295	11.36	1,545,000	110,000	....	78	43	60	Very dirty refrigerator.
304	Milk depot,	3.65	1.0253	10.84	175,000	No. l'ge.	....	78	43	60	Bottled "sterilized" milk.
	New York.										
305	Milk depot,	2.65	1.0319	11.29	1,190	....	....	88	66	77	
306	Milk depot,	3.45	1.0341	12.80	91	....	....	88	66	77	Bottled "sterilized" milk.
307	Milk depot,	5.00	1.0340	14.64	....	....	....	88	66	77	Bottled "sterilized" milk.
308	Wagon,	2.80	1.0312	11.30	8,000,000	No. l'ge.	.20	91	71	81	
309	Restaurant,	3.10	1.0342	12.29	1,850,000	130,000	.21	91	71	81	
310	Restaurant,	4.50	1.0322	13.59	232,000	9,000	.21	91	71	81	Formalin found.
311	Milk depot,	4.60	1.0320	13.66	2,100,000	No. l'ge.	.25	91	71	81	
312	Restaurant,	4.00	1.0318	12.89	....	....	.27	91	71	81	
313	Wagon,	5.60	1.0337	15.30	2,790,000	110,000	.26	91	71	81	
314	Milk depot,	3.60	1.0320	12.46	7,170,000	192,000	.23	91	71	81	
315	Wagon,	2.60	1.0325	11.39	....	....	.23	91	71	81	
316	Restaurant,	3.10	1.0327	12.04	15,000,000	400,000	.21	90	69	80	
317	Variety store,	4.10	1.0320	12.94	7,800,000	1,212,500	.17	90	69	80	Bad odor. Dirty store.

318	Variety store,	3.50	1.0320	12.84	19,382,500	787,500	.21	90	69	80	
319	Variety store,	3.40	1.0338	12.67	4,120,000	85,000	.18	90	69	80	
320	Variety store,	3.60	1.0308	12.04	12,925,000	1,250,000	.18	90	69	80	
321	Variety store,	3.90	1.0314	12.67	16,125,000	650,000	.29	90	69	80	
322	Variety store,	3.15	1.0339	12.39	....	....	.22	90	69	80	
323	Milk depot,	3.20	1.0326	13.13	8,160,000	55,000	.19	90	69	80	
324	Wagon,	4.80	1.0337	14.30	47,500	4,500	.18	81	64	72	Milk bottled on farm.
325	Wagon,	3.10	1.0332	12.04	67,500	7,000	.20	81	64	72	Milk very cold.
326	Wagon,	4.20	1.0315	13.06	208,000	12,000	.18	81	64	72	
327	Wagon,	3.60	1.0317	12.39	10,380,000	386,000	.20	81	64	72	
328	Wagon,	3.10	1.0320	11.74	1,550,000	....	.20	81	64	72	
329	Restaurant,	2.80	1.0322	11.55	149,000	8,500	.20	81	64	72	
330	Wagon,	4.00	1.0335	13.32	100,500	9,000	.20	81	64	72	Milk bottled on the farm.
	Williamsport.										
331	Milk depot,	4.00	1.0355	13.82	91,250	6,500	....	54	50	52	Milk about five hours old.
332	Milk depot,	4.25	1.0335	13.61	125,000	4,000	....	54	50	52	
333	Variety store,	2.90	1.0280	10.62	1,395,000	2,000	....	54	50	52	Milk about thirty hours old.
334	Milk depot,	4.00	1.0328	13.15	342,500	24,000	....	54	50	52	
335	Variety store,	3.20	1.0305	11.61	4,520,000	800,000	....	54	50	52	Shipped in on train.
336	Milk depot,	6.10	1.0303	15.04	1,690,000	45,500	....	54	50	52	About forty hours old.
337	Variety store,	4.90	1.0312	13.82	94,500	52,500	....	54	50	52	
338	Milk depot,	3.40	1.0306	11.87	83,700	8,050	....	54	50	52	
339	Wagon,	4.00	1.0348	13.64	69,000	7,000	....	61	37	49	
340	Wagon,	4.20	1.0330	13.43	299,000	14,000	....	61	37	49	Last night's milk.
341	Wagon,	4.20	1.0305	12.81	228,000	1,500	....	61	37	49	Morning's milk.
342	Wagon,	....	....	....	30,250	12,500	....	61	37	49	Warm. Bottled morning's milk.
343	Wagon,	4.10	1.0336	13.46	127,000	15,000	....	61	37	49	Last night's milk.
344	Wagon,	3.70	1.0312	12.38	273,000	45,000	....	61	37	49	Last night's milk.
345	Wagon,	3.50	1.0344	12.94	87,375	4,875	....	61	37	49	Morning's milk.
346	Wagon,	4.80	1.0310	13.65	70,000	4,550	....	61	37	49	Boracic acid found.
347	Wagon,	4.10	1.0325	13.19	22,000	7,000	....	65	38	52	Last night's milk.
348	Wagon,	4.80	1.0307	13.59	65,000	11,000	....	65	38	52	Last night's milk.
349	Wagon,	3.50	1.0320	12.34	35,500	3,500	....	65	38	52	
350	Wagon,	4.60	1.0311	13.43	9,000	....	....	65	38	52	Milk still warm.
351	Wagon,	4.40	1.0308	13.12	11,000	....	....	....	....	....	Morning's milk.
352	Wagon,	4.20	1.0300	13.18	19,000	1,000	....	....	....	....	
166	Milk depot,	3.20	....	....	....	....	....	....	....	....	Taken in Altoona.

TABLE NO. II.—(2)*

City of—	Place of Selection.	Average per cent. of fat.		Average specific gravity.		Average per cent. Total solids.		Average number of bacteria, per cc.		Average acidity.		Average mean temperature on days of taking samples (degrees).
Philadelphia,	Wagons,	3.59	(4)	1.0314	(4)	12.30	(4)	1,924,500	(4)	....	....	76
	Milk depots,	4.00	(12)	1.0314	(12)	12.77	(12)	5,120,000	(7)	....	....	76
	Variety stores,	4.23	(5)	1.0317	(5)	12.30	(4)	2,390,000	(1)	....	....	76
	Railroad station,	4.26	(8)	1.0319	(8)	12.85	(8)	1,390,000	(8)	....	....	76
	Restaurants,	3.30	(6)	1.0288	(6)	11.43	(6)	13,072,000	(6)	....	....	76
	All sources,	3.91	(35)	1.0309	(35)	12.45	(35)	5,028,000	(27)	.176	(35)	76
Reading,	Wagons,	3.67	(11)	1.0314	(11)	12.31	(11)	1,603,000	(11)	....	....	83
	Milk depots,	3.70	(16)	1.0303	(16)	12.01	(16)	1,968,600	(10)	....	....	83
	Restaurants,	4.60	(2)	1.0280	(1)	14.83	(1)	1,881,700	(3)	....	....	83
	All sources,	3.76	(29)	1.0307	(28)	12.24	(28)	1,773,500	(24)	.178	(23)	83
Harrisburg,	Wagons,	3.08	(16)	1.0313	(16)	11.65	(16)	3,829,000	(16)	....	....	74
	Milk depots,	3.01	(7)	1.0332	(7)	12.05	(7)	4,803,000	(7)	....	....	74
	Railroad station,	4.75	(6)	1.0304	(6)	13.76	(6)	1,117,000	(3)	....	....	74
	Restaurants,	2.60	(2)	1.0315	(2)	11.13	(2)	4,005,000	(2)	....	....	74
	All sources,	3.57	(31)	1.0319	(31)	12.11	(31)	4,693,000	(29)	.194	(23)	74
York,	Wagons,	3.75	(22)	1.0311	(22)	12.49	(22)	1,737,000	(17)	....	....	77
	Milk depots,	3.93	(9)	1.0294	(9)	12.21	(9)	3,318,000	(9)	....	....	77
	All sources,	3.80	(31)	1.0319	(31)	12.47	(31)	2,567,000	(27)	.182	(31)	77
Altoona,	Wagons,	3.80	(18)	1.0298	(18)	11.64	(18)	4,450,000	(18)	....	....	69
	Milk depots,	3.55	(13)	1.0299	(6)	12.04	(6)	2,930,000	(6)	....	....	69
	Railroad station,	3.90	(4)	1.0305	(4)	12.44	(4)	1,663,000	(4)	....	....	69
	Restaurants,	2.35	(2)	1.0308	(2)	10.66	(2)	8,955,000	(4)	....	....	69
	All sources,	3.50	(37)	1.0320	(31)	11.40	(31)	6,380,600	(31)	.197	(37)	69
Pittsburgh,	Wagons,	3.17	(5)	1.0320	(5)	11.95	(5)	60,000	(1)	....	....	71
	Milk depots,	2.87	(19)	1.0323	(19)	11.70	(19)	7,891,000	(12)	....	....	71
	Variety stores,	3.14	(11)	1.0321	(11)	11.92	(11)	22,660,000	(5)	....	....	71
	Railroad station,	3.71	(9)	1.0316	(9)	12.48	(9)	3,670,000	(7)	....	....	71
	Restaurants,	2.87	(7)	1.0306	(7)	11.03	(7)	23,556,000	(6)	....	....	71
	All sources,	3.04	(51)	1.0314	(51)	11.84	(51)	16,634,000	(31)	.207	(45)	71
Allegheny,	Wagons,	2.55	(3)	1.0331	(3)	11.44	(3)	2,025,000	(1)	....	....	66
	Milk depots,	2.82	(5)	1.0318	(5)	11.48	(5)	3,582,000	(5)	....	....	66
	Variety stores,	3.35	(4)	1.0304	(3)	11.65	(3)	1,078,000	(3)	....	....	66
	Restaurants,	2.60	(6)	1.0307	(6)	10.93	(6)	15,786,700	(6)	....	....	66
	All sources,	2.77	(18)	1.0314	(17)	11.31	(17)	8,305,000	(14)	.188	(17)	66
Erie,	Wagons,	3.55	(17)	1.0310	(17)	12.78	(17)	4,068,000	(14)	....	....	65
	Milk depots,	3.93	(7)	1.0312	(7)	12.68	(7)	343,750	(7)	....	....	65

	Variety stores, ...	3.72	(7)	1.0321	(7)	12.71	(7)	9,335,000	(6)	....	....	65
	All sources, ...	3.67	(31)	1.0313	(31)	12.80	(31)	4,122,000	(28)	.187	(31)	65
Scranton, ...	Wagons, ...	4.15	(5)	1.0299	(5)	12.59	(5)	1,817,(0)	(4)	....	....	63
	Milk depots, ...	3.75	(9)	1.0335	(8)	12.59	(9)	1,923,000	(8)	....	....	63
	Variety stores, ...	3.99	(12)	1.0313	(12)	12.67	(12)	4,398,000	(10)	....	....	63
	Restaurants, ...	3.20	(1)	1.0295	(1)	11.36	(1)	1,545,000	(1)	....	....	63
	All sources, ...	4.03	(27)	1.0305	(27)	12.57	(27)	2,961,600	(23)	.161	(18)	63
New York, ...	Wagons, ...	4.20	(9)	1.0326	(9)	12.76	(9)	2,892,000	(8)	....	....	78
	Milk depots, ...	3.75	(6)	1.0328	(6)	12.83	(5)	3,810,000	(3)	....	....	78
	Variety stores, ...	3.60	(6)	1.0322	(6)	12.51	(6)	12,070,000	....	....	....	78
	Restaurants, ...	3.48	(5)	1.0326	(5)	12.47	(5)	4,307,800	(4)	....	....	78
	All sources, ...	3.66	(26)	1.0325	(26)	12.66	(26)	5,907,700	(20)	.212	(23)	78
Williamsport, ...	Wagons, ...	3.86	(13)	1.0320	(13)	13.15	(13)	95,400	(14)	....	....	51
	Milk depots, ...	4.35	(5)	1.0325	(5)	13.50	(5)	466,500	(5)	....	....	51
	Variety stores, ...	3.67	(3)	1.0299	(3)	12.02	(3)	2,003,000	(3)	....	....	51
	All sources, ...	4.32	(22)	1.0306	(22)	13.18	(22)	437,100	(22)	....	....	51
	All milk examined, ...	3.62	(338)	1.0312	(331)	12.29	(331)	5,564,300	(276)	.189	(277)	....
	All milk depot samples,	3.53	(108)	1.0315	(102)	12.02	(102)	3,821,700	(77)	....	....	....
	All variety store s'ples,	3.62	(50)	1.0317	(46)	12.55	(46)	8,263,000	(35)	....	....	....
	Al wagon samples, ...	3.57	(123)	1.0312	(123)	12.32	(123)	2,657,500	(108)	....	....	....
	All R. R. sta. samples, .	4.13	(27)	1.0340	(27)	12.87	(27)	2,128,600	(22)	....	....	....
	All restaurant samples,.	3.09	(31)	1.0307	(28)	11.83	(29)	11,961,700	(32)	....	....	....

*The number in parenthesis indicates the number of tests used in making averages.

THE DAIRY MARKETS OF PENNSYLVANIA.

By PROF. H. HAYWARD, *Assistant in Dairy Husbandry, State College, Penna.*

Some one has aptly said that it takes more skill to market a product successfully than to produce it. No matter how much thought and care has been spent in its growing or manufacture, a great deal more skill and care must be spent if it is to leave the hands of the grower or manufacturer in the best possible manner. That this should be the ambition of any and every one who produces for the market, goes without saying and, under the existing circumstances of close competition, it is especially true that the man who produces for the dairy markets of this State must use the utmost pains, if he is to compete successfully with the products of other states, which, with the present transportation rates, can be put down at our door so cheaply.

In order to dispose of any product successfully, one must be familiar with every phase of the market, know the cost of producing goods, the cost of getting them to the buyer, and estimate carefully the lowest price for which he can sell and still have a fair compensation for his outlay of time, money and labor. To this end, one must make a careful study of the particular market which he wishes to supply and make his goods conform as nearly as possible to its requirements.

The dairy market of Pennsylvania has changed to a marked degree during the past fifteen years; a fact due largely to the remarkable advance in the science and practice of dairying, which has completely revolutionized the industry. A study of the State's dairy interests has clearly brought out the following points:

1st. Good butter can be made over a wider area than was formerly supposed possible.

2d. With the present skilled methods, good butter made west of the Mississippi, where grass, grain and labor are cheap, can be placed before Eastern consumers cheaper than butter made here in the East.

3rd. Dairymen and farmers who are still pursuing the methods of fifteen years ago, are being crowded out, and cannot compete in the best dairy markets.

4th. It is not difficult, with modern methods, to produce butter which will bring as much in the open market as certain brands which have sold for $0.75 and $1.00 per pound.

5th. Outside of a limited trade, which seems to be constantly diminishing, there is no longer the opportunity for obtaining "fancy" prices for butter. The most important fact brought out from these points is that the dairyman must avail himself of up-to-date methods if he is to succeed at all in the business.

Pennsylvania is one of the great dairy states of the Union, ranking third in amount of butter produced, sixth in cheese production, and third, in number of milch cows. Yet it is the opinion of the writer that the markets of the State have not nearly reached their highest possible development. In many parts of the State the finest goods come from other states; this is explained, at least in part, by the fact that, as a whole, our dairymen have not kept abreast of the times in the manufacture and marketing of their goods. This has had a tendency to bring our dairy products into disfavor in many of our own markets, and it wll undoubtedly take time to regain our reputation. One of the greatest faults of our dairy products is their lack of uniformity. This may be due to the lack of skill or to the carelessness of the dairyman, and this, in turn is partially due to the lack of interest manifested by the State itself in one of its most important industries.

The writer is unaware of any other Commonwealth which does so little for the direct encouragement of the dairy industry. Some of the other leading dairy states, notably New York and Wisconsin, have dairy instructors who are responsible to the State Dairymen's Association, or to the Commissioner of Agriculture. These instructors visit the creameries and cheese factories of the State and give instruction to the butter and cheese makers. It is to be noticed, in this connection, that these very states supply Pennsylvania with a large part of the best dairy goods sold in her markets, and that these states have a large export demand for their surplus production.

Nearly every state, whose dairy industry is important, has also an active State Dairymen's Association, either wholly or in part self-sustaining, whose annual meetings gather a large number of dairymen in a two or three days session. Care is taken to secure an eminent specialist to instruct in these gatherings, and leading supply houses are invited to exhibit their most improved apparatus. An exhibit consisting of several classes, in which liberal prizes are offered in butter and cheese, attract the makers of dairy products to bring or send their exhibits. In this way enthusiasm and ambition is aroused in those who are largely responsible for the quality and, consequently, for the reputation of the State's goods.

At the state fairs of other important dairy states, very liberal prizes are offered for dairy exhibits. Exhibits of over three hundred entries from nearly as many makers are not unusual at these fairs. Such competition among the men who handle the butter paddle and work over the cheese vat must result beneficially in the end. Canada, one

of our most active competitors in the English markets, has been very active in encouraging her dairy industry. She provides stationary and traveling dairy schools, dairy conventions and exhibitions, and has recently offered a bonus to creameries and cheese factories having a cold storage attached.

In these directions, Pennsylvania is doing almost nothing. Her one dairy school is now not nearly large enough to meet the demands of young men who are anxious to improve themselves as dairymen. Where other state dairy schools annually instruct classes numbering a hundred students, Pennsylvania's dairy school is badly cramped with forty, and many are turned away each year for want of room.

As we have stated above, our dairy products lack uniformity, which is absolutely essential to the reputation of the products of any state. To this end, there must be some degree of uniformity in the methods of production; and this can be brought about only through some systematic training for the manufacturers. This would undoubtedly cost something, but when the importance of the industry to the State is considered, a judicious expenditure would certainly appear reasonable.

To give a clearer idea of the extent of our dairy industry, the following figures are taken from the last dairy statistics issued by the U. S. Department of Agriculture. In 1890, Pennsylvania produced 368,906,480 gallons of milk, valued at nine cents per gallon; 76,809,041 pounds of butter in home dairies and 19,390,387 pounds in creameries, valued at twenty cents; 439,060 pounds of cheese in home dairies, and 5,018,837 pounds in cheese factories, valued at eight cents per pound. Thus the total value of the annual dairy products of this State, exclusive of skim milk, buttermilk and veal calves, amounts to $52,878,100.56. These figures may be assured to represent fairly the value of our dairy products. While the price of butter has declined somewhat, the amount produced has increased proportionately, so that the above estimate may be taken as a conservative one.

Since Pennsylvania is a State in which dairying is one of the chief agricultural industries, a large part of the milk, butter and cheese produced goes upon the market and sells for what it will bring. It is the purpose of this report to describe as accurately as possible, after a somewhat extended study of the dairy markets of the State, the manner in which these goods were sold and, if possible, to offer some suggestions in the way of improvement, which have impressed themselves upon the writer during his observations. In order to treat the subject systematically, it will be considered under its natural heads; milk, butter, cheese, and miscellaneous dairy products.

MILK.

A dairyman who is so situated that he can sell his milk directly to the consumer will find this branch of dairying more profitable than either butter or cheese making. That this is true can be readily seen

upon noting that the price usually obtained for milk would be a very high price for the butter or cheese that could be made from it. Then, too, the milk trade, as usually conducted, requires little apparatus and little room for its handling.

However, the producer does not usually sell directly to the consumer and, in every large town or city, the apparent large margin between the wholesale purchase price and the retail selling price has attracted so many milk dealers that the trade is cut up and scattered to a deplorable extent. This makes the expense of delivering the milk so great as to leave little real profit to the dealer. He, in turn, reduces the price to the producer, so that under the existing conditions, there is much less money in the business for any one than there ought to be under more favorable conditions.

In one city, which the writer visited, it was estimated that the milk supply for the 21,000 inhabitants was handled by sixty-four milk wagons and a large number of milk depots. The average milk wagon and depot handled between thirty-five and forty gallons of milk a day, for which the dealer paid twelve cents per gallon, delivered on the platform. As the freight in this case was four cents per gallon, the farmer received but eight cents per gallon for his milk delivered at the railroad station. In no case was it possible to assertain how much fat the milk contained. Assuming the average per cent. of fat in average milk, 3.8 per cent., then since a gallon of milk weighs ten pounds, each gallon would yield .44 of a pound of butter. Now, to equal the amount for which the milk is sold, the butter must bring about eighteen cents per pound. This is certainly a good price, considered from the butter maker's point of view. Therefore, although the price of milk may seem low, other things being equal, it is far better to sell the milk than to make butter.

There are, however, many drawbacks to selling milk under present conditions. In the first place, it frequently happens that the milk is shipped to parts unknown to the shipper, and sometimes, as the writer learned, to utterly unreliable parties. In some places it is the rule for a shipper to send milk, paying its freight, a month before any money is paid by the dealer, who pays each month only for the milk received during the preceding month. This means, in other words, that the shipper must advance milk and the freight on it a full month, and this oftentimes to parties irresponsible financially. As a point in hand, the case may be cited of one shipper who told the writer that he had lost $150, within a few months, through being unable to collect what was due him. This would, of course, soon consume any profit which there may be in the business, and explains, in part, the fact that the shippers took little interest in their business. All the work was left to women, but little grain was fed, no care was taken to improve the cows, and no one knew the quality of the milk he produced, nor

how much it cost to produce it. Shippers did not, in any case, try to benefit themselves by an association, but each man sold for any price he could get, regardless of any effect it might have upon the future market. With but one exception, the shippers who were questioned, gave the invariable answer that they were not paid for their trouble. Hence it seems that, under the existing conditions, shipping milk is not profitable.

Milk is usually shipped in to the cities in cans holding from five to ten gallons. In one instance the train bringing a large part of the city milk supply reached the city about midday, with the mercury at 75 degrees or higher. The milk dealers met the train; each took his milk and at once began to deliver it. As this milk had received little attention before shipping, and as it was, in being delivered, dipped or drawn from cans unprotected save by a wagon top, it is to be wondered how it could be sweet when used, without the aid of preservatives. In small cities, it was found that a dealer handled from thirty-five to forty gallons a day. Out of every fifty quarts sold, some milk men calculated that they lost four quarts by full measure. But they said that this loss would not pay for bottling, which would, of course, save the loss.

The average retail price for milk, throughout the State was found to be five cents per quart, with the usual reductions of from one to two and one-half cents a quart to hotels and restaurants taking a large quantity. If milk costs the milkman 2½ cents per quart, by handling 150 quarts, which is a good average, he will make from $3 to $3.75 per day. This assumes that he sells all his milk and can collect all his bills. As a matter of fact, however, there is more or less surplus which is churned for the buttermilk and which, in most cases, does not pay the first cost of the milk. Then again, in times of financial depression, such as have prevailed during the past few years, there is great difficulty in making collections, consequently, when the milkman pays for maintaining a horse and wagon, pays for his cans, and meets the sharp competition which exists in the business, there is not much more than a bare living to be derived. Since, under the existing conditions, no one handling the milk, from the producer to the consumer makes but a meagre living, there is little inducement for either the producer or the dealer to supply first class milk in a first class manner.

Notwithstanding these facts, there are a few milk men who are taking advantage of modern methods and are making money in the business. Here, as everywhere, it is the man who has a superior article, delivered in a superior manner, who makes the money. One of these men was met in Allegheny. He sold all his milk in bottles at eight cents a quart; it was of superior quality, testing between four and five per cent. fat. He solicited only the best trade and lost almost nothing through failure to collect bills. He handled 400 quarts

daily, knew where it all came from, and, in fact, controlled all the cows producing it. This, as he told the writer, netted him 15 cents per gallon, at his farm, bottled. Another man was met who supplied Jersey milk entirely for ten cents per quart, the year around, and did not sell smaller quantities than a quart. All the milk was bottled in glass-stopped jars at the farm and was delivered in refrigerator wagons to an aristocratic trade. These cases are cited merely to show what can be done where skill and intelligence are brought to bear upon the problem.

As we have stated, by far the greater part of the milk sold in this State is not handled by up-to-date methods. Although the business is crowded with average milk men, there is still a demand and good prospects for enterprising men, with a knowledge of the business, who will supply a superior article of pasteurized or raw milk and cream in an attractive manner. The writer cannot refrain from mentioning one possibility in the city milk supply of our State. Numberless instances might be cited, showing that the most successful milk men are those who control the production as well as the sale of the milk they handle. In this way, knowing the entire history of the product, they can guarantee its quality. Now the suggestion is that those supplying the milk trade in our smaller cities, form an association for their mutual protection and for the control of the milk trade in the city, whose supply they furnish. It seems that such an association could produce the highest grade of milk at such a cost that it could be retailed at the present rates and still allow a much greater profit than either producer or retailer now makes. The writer does not know of any such association, but to him this seems like a mere extension of the idea which has proven a success in the co-operative creamery system.

His plan would be that instead of taking the milk to a creamery to be made into butter, after it has been properly cured at the farm, it should be shipped to the creamery in the city. A quantity sufficient for the milk supply, should be bottled, enough to supply the cream trade should be skimmed, and the skim milk made into cottage or cream cheese, and the surplus made into butter or cheese, as might be deemed best. To induce the shipment of a good quality of milk, after deducting the necessary running expenses, dividends should be made, as they now are, on the basis of the percentage of fat which the milk contains. Such a system should materially reduce the cost of delivering milk. As one milk dealer stated, the milk trade is cut up to such an extent as to make an enormous expense in delivering. Such a saving in expenses would add materially to the profits of the business. The writer wishes it to be distinctly understood that he realizes there are flaws in the system described above. Yet, the possibilities of such a modification of a system now in use in many places made a very forcible impression upon the writer when these studies were made.

BUTTER.

Probably there is no other State in the Union which affords so many good markets for butter as Pennsylvania. This is partly due to the fact that, with two exceptions, the State contains more cities with a population of ten thousand or more inhabitants than any other, and partly to the efficiency of the State Department of Agriculture, which so enforces the laws that but little oleomargarine is now sold in the State. Like those who produce for the milk market, however, the butter producers have not as yet adapted themselves to their conditions. The result is that the State's production of butter does not yield nearly so great a profit as it might if differently managed.

In the first place, over 76,000,000 pounds of the total 96,000,000 pounds produced in the State, are made in private dairies, and do not, in the open market, bring within from three to five cents per pound as much as average creamery butter. In the second place, a large proportion of the State's annual production is made during the summer months when there is an over production of butter nearly everywhere, and when consequently, it is a drug upon the market. And, in the third place, the quality of butter, in a large portion of the State is not such as to commend it to dealers who want a first class uniform article throughout the year. Although without a question, there is more fancy high-priced butter made in Pennsylvania than in almost any other State.

While it is possible to produce just as good butter in a private dairy as in a creamery, yet, as a matter of fact, all who have given the subject any thought and observation, must acknowledge that, as a rule, creamery butter is of better quality than average dairy butter. The reason is quite evident; in a great many home dairies, the work is carried on, as work is in too many other departments of the farm, in a somewhat careless manner, and without that care and attention which is given to milk and cream in the creamery. The home dairy facilities are not always adequate, and the result is that the butter is not uniform in color, salting, or flavor. In summer, it is soft and greasy, containing a good deal of buttermilk, which could not be removed because of the high temperature at which the butter was churned, and which soon makes the butter strong. In winter the butter is likely to be crumbly, because the cream is allowed to freeze. Through a better education of butter makers and because of improved machinery, the quality of creamery butter is constantly improving. Now there is not the same degree of improvement in dairy butter, consequently, the difference between the price of creamery butter and that of dairy butter becomes continually greater. And, as one old dealer in dairy goods said; the daughter of the American farmer is not so good a butter maker as her mother was, because she will not take the necessary pains.

A large part of this poor butter is sold to the huckster who makes weekly visits to collect such farm produce as he can handle. The butter is wrapped in a cloth and put into a box, containing, perhaps, salt pork, vegetables and other things which tend to give the peculiar flavor for which the huckster butter is noted. After the butter becomes the property of the huckster, it is taken to town where it is picked over and the best culled out by each buyer, until it is all disposed of for what it will bring. A number of grocers, who are selling country butter, said it was an unsatisfactory article to handle, because it is so irregular in quality, but that they must have it to supply a certain demand. Others said it gave fair satisfaction except in the fall and spring. Still others said they bought dairy butter only when they could get it from certain customers whose produce was uniformly good. Again others would not handle it at all. When the gross selling price of creamery butter gets down to thirteen cents, it will be readily seen that dairy butter cannot pay the cost of its production. If, however, the 76,000,000 pounds of dairy butter could be sold for as much as creamery butter there would be a gain of at least $3,040,000 over what it now brings; quite a sum to be distributed each year among the farmers of our State.

Bearing these facts in mind, the question comes naturally, what can be done at once to better present conditions? One answer which has suggested itself forcibly is as follows: instead of making poor, cheap butter, under adverse conditions and with a great deal of labor on the part of the already overtaxed housewife, let the milk be turned into veal. Perhaps a few figures will help to explain the plan. The average dairy cow of Pennsylvania produces, annually, 3,000 pounds of milk and is milked about nine months or thirty-seven weeks in the year. A calf could be fattened every five or seven weeks, on an average during the period of lactation. These calves will sell for about $5.50 each, bringing a total of $38.50. The usual price for such calves, at three days of age, is $1. If this price be paid, there is a net receipt for each cow, of $31.50. Such a plan involves very little labor, and if the figures compare favorably with the price of poor butter, it is certainly worth some consideration. Now, the 3,000 pounds of milk from the average cow are equivalent to about 125 pounds of butter, and to bring the price of the veal, $31.50, this would have to sell for twenty-five cents a pound, which is about ten cents a pound more than the average price of dairy butter.

Various other suggestions occur to one who has studied the situation. As has been stated, some markets demand dairy butter and have great difficulty in getting it during the winter months. If dairymen would have their cows fresh in the fall they could meet the demand for their butter when it brings its highest price. They would, too, get a larger yield from their cows than they do by following the

usual custom of having them come in, in the spring. Winter dairying on the farm has another advantage, since, if precaution is taken to keep the milk, cream and butter from contaminating odors and from freezing, other things being equal, better butter can be made during the cold months than during the warm weather, and, without question, the most important consideration in the butter question is that of quality.

Too much care can not be taken in the packing of butter, the style of package and, in fact, everything which impresses the buyer either favorably or the opposite. In visits to a great number of markets and stores during the past summer, the writer found very little dairy butter packed in a neat and attractive manner. In the northern part of the State a great deal of dairy butter is put up in wooden pails. While butter can be more easily shipped in this way, it does not usually bring a satisfactory price. The buyer does not expect to find the best quality put up in this way. Nor do we find much of the best dairy butter marketed in the old style three or five pound roll, wrapped in a cloth. Butter in one pound prints, wrapped in parchment paper is rapidly gaining favor, because it is more attractive to the consumer and is more easily and economically handled by the grocer. Avoid the use of cloths on butter. Parchment paper, which is much better, can be readily obtained at a moderate price. If rolls are made, make them in such shape and of such size that they may be wrapped easily and neatly with the paper. Another point that may be considered in this connection is that of color. Too frequently in the fall, winter and spring, dairy butter is so light as to be unattrative. This could be very easily overcome by the use of a little butter color. Select that shade which ones trade prefers, and then, by the use of varying amounts, keep the color uniform throughout the year.

In general, much more satisfactory results are obtained when the producer can sell direct to the consumer. As, it must always be remembered, every one who handles the butter must have his pay for doing so. Again, when the producer sells directly to the consumer, he can frequently get, for a superior article, something more than the market price. Thus, he not only has the best market for his butter, but, also, often finds customers for his vegetables, eggs, poultry and other products.

After looking over all conditions, one is convinced that there is little excuse for the man who sells his butter at six or eight cents a pound. Butter is not sold for six cents because there is an over supply of good butter, but because there is an over production of poor butter. Many are improving their butter by the use of hand separators. While this often helps it does not, in most cases, bring the standard up to creamery butter. By the use of hand separators, with the gathered cream system, a creamery can be profitably maintained in almost any good

farming community. And, until the creamery system expands so as to occupy every part of the State, there will always be an abundant supply of poor, cheap butter.

CREAMERY BUTTER.

The writer was somewhat surprised to find that the creamery butter of the State occupies a small and uncertain place in its markets. Outside of Philadelphia, there is very little Pennsylvania creamery butter to be found. Most of the creamery butter in our markets comes from the Elgin district, in Illinois, or from New York. In less than a dozen cases did the writer find our State creamery butter sold in the markets and groceries of Western Pennsylvania.

That most of our creamery butter is sold in other states, usually a little below highest quotations, and that it is so little used here may be due in part to the fact that only a small fraction of our total amount of butter is made in the creamery. When those who sell the Elgin or New York butter were asked why they did not handle the State creamery butter, the almost invariable answer was that the quality of our butter is not uniformly first class, and that it does not give satisfaction to their trade. In the city of Pittsburgh, which supplies very many of the coal and oil districts, almost no State creamery butter is marketed. Two of the largest butter commission merchants stated that Pennsylvania can not make so good butter as that of the Elgin region, because we lack the grass necessary for it. Other commission men in Philadelphia stated that the body of the western butter is vastly superior to that of our goods. The most general criticism of our State creamery butter was its lack of uniformity and body, although another quite important one was the uncertain and irregular supply. With these objections overcome, the butter made in this State should stand as well and bring as much as Elgin or New York butter.

One reason that our butter is not so good as that made in the West, is brought out by the remark of a prominent butter dealer, who says that there is not the skill used in its manufacture here that is used in the West; that dairy education is not so far advanced with us as in other states, and that there are not the butter exhibitions here to stimulate our butter makers. Then, too, we have no butter boards of trade on which, in other states, all or most of the butter made in its vicinity is sold, and which must always be guaranteed to grade as extra. When a creamery manager finds that his butter is not reaching the standard, and that buyers are discriminating against his goods, he at once takes steps to ascertain the cause and to bring his product up to the standard. Again, when selling on a board of trade, a number of producers meet every week, know by a special telegram what the market is, and meet the buyers, thus keeping in touch generally with

their business. On one board of trade in New York, one on which some Pennsylvania butter was sold, the writer saw butter sell within one-half cent of New York quotations. This is a much better way of selling than to ship to a commission house, pay the freight, cartage, and commission. As one buyer, whom the writer met on a board of trade put it: "It is all right if the commission house buys the butter, but when it is shipped to the commission house to be sold, it is an entirely different thing."

Another advantage of a butter board of trade is that it leads to the adopting of a uniform style and size of package, thus enabling dealers who handle butter in large quantities to fill their orders with a uniform article. With one or two exceptions, all dealers with whom the writer talked were strong in their opinion that dairy boards of trade, established at dairy producing centres, would be of great advantage. In New York there are no less than thirteen of these organizations, and so far as the writer was able to learn, they are well sustained by local producers. Since it was found that most Pennsylvania dairymen are unfamiliar with the management of these boards of trade, and as they are of such importance, it seems wise to give the principal part of the constitution and by-laws of that most successful and widely-known organization, The Elgin Board of Trade.

RULE I—MEMBERSHIP.

Qualification.

Section 1. Any person of good character and credit, and of the legal age, on presenting a written application, indorsed by two members, and stating the name and business avocation of the applicant, may be admitted to membership in the Association, upon approval by a majority vote of the Board of Directors, and upon payment of an admission fee of twenty-five dollars, or upon presentation of a certificate of unimpaired or unforfeited membership, duly transferred, and by signing an agreement to abide by the Rules, Regulations and By-laws of the Association, and all amendments that may be made thereto.

Admission fee.

RULE II—ASSESSMENTS.

When due.

Section 1. When the annual assessment is made, it shall be considered due and payable. It shall be the duty of the Secretary to report to a meeting of the Directors, to be held on the Monday following the expiration of 60 days from the date of such assessments, the name of every member who has neglected or refused to pay his assessment; and it shall then be the duty of the Directors to suspend such defaulting members from the privileges of the Association. Any member so suspended may, within six months from the date of sus-

Delinquents to be suspended.

pension, make application to the Board of Directors to be re-instated, and upon the payment by him, to the Secretary, of double the defaulted assessment, the Board of Directors may grant such application. If, at the end of six months from the date of such suspension, any member shall have failed of re-instatement as above provided, he shall be deemed to have forfeited his membership. Reinstatement.

Section 4. There shall be elected at the annual meeting—

1. A Board of five Directors.
2. A Committee of Arbitration, consisting of five members.
3. A Committee of Appeals, consisting of three members.

RULE IV—DUTIES OF THE BOARD OF DIRECTORS.

Section 2. The Board of Directors shall elect from their own number a President, Vice President and Treasurer. They shall also appoint a Secretary, a Sergeant-at-Arms and such Inspectors as may be deemed necessary, and fix their terms of office, and the compensation to be paid them; reserving, however, the power of revoking such appointments at their own will and pleasure.

Section 3. The Board of Directors may require of all appointees an oath to well and faithfully perform all and singular the duties of their office, and a good and sufficient bond to secure such performance.

RULE X—INSPECTION.

Section 1. It shall be the duty of the Inspector or Inspectors appointed by the Board of Directors, at the request of any member of the Association, to inspect the weights and the quality of any lots of butter or cheese, and to issue to such a member a certificate truthfully setting forth the facts as to the weight and quality of said butter and cheese according to the regulations governing the inspection of butter and cheese. To issue certificates.

RULE XIII—CALL BOARD AND REGULAR SALES.

Section 1. It shall be the duty of the Secretary at every session of the Association to open a call board for the sale of butter and cheese; said call to begin at 1.30 and close at 2.30 P. M., unless sooner closed by a majority vote of the Association Call board.

Quality of butter offered.

Section 2. All butter offered on the call board, unless otherwise specified, shall be extra, and shall be entered on the Board in the name of the factory where made; it being understood that the owner or operator of such factory shall be a member of the Association in good standing.

Quality of cheese offered.

Section 3. Any member offering cheese on the call board shall specify whether full cream or skimmed, and if the latter, how much.

Sales recorded.

Section 4. All sales made on the call board shall be recorded by the Secretary, under the head of regular sales.

Regular sale defined.

Section 5. A regular sale is a sale defined to be effected during the regular Monday session of the Association, both buyer and seller being present in person in the rooms of the Association.

Fine may be imposed.

Section 6. All regular sales shall be reported to the Secretary, giving the number of boxes of cheese, average weight and price per pound; also the number of pounds of butter, and price of same. Sales reported must be actual and bona fide, and there must be no misrepresentation in regard to price. Sales must be reported before close of the session, and any member refusing to report, shall be subject to a fine of not less than one, nor more than five dollars, for each and every offense.

Section 9. Every member reporting a regular sale shall, if required by the President, at the request of any member of the Association, furnish name of buyer.

Quotation committee.

How selected.

Section 10. A Quotation Committee, consisting of five members, shall be appointed by the President and confirmed by a majority of the members present and voting. Two members of this committee shall be chosen from among the buyers, two from the sellers, and one who may be both a buyer and seller, or neither, at the discretion of the President.

Meets after calls.

Establish market.

Section 14. Immediately after the close of the call board it shall be the duty of the Quotation Committee to meet at once, and after examining the record of regular sales, and taking into account the quality of butter sold, as well as offered and remaining unsold, and taking into consideration the state of other markets of the country, and making such inquiries as they may choose to make of both buyers and sellers, to establish the market price of butter for that day, and declare the

same before adjournment, and the price so established shall be known as the "Board Price," and shall govern in all contracts. "Board price."

Section 15. The establishment of such "Board Price" shall not invalidate any sales made between members, either on the call or otherwise, at a price fixed at the time the sale was consummated. Not invalidate other sales.

RULE XIII—REPORTS OF MANUFACTURERS.

Section 1. Every member of this Association, who is a manufacturer, or who is in any way connected with a creamery or cheese factory, shall be required to furnish to the Secretary monthly statements of the products of the factory or factories which he may own or be connected with. Reports of manufacturers.

1st. The number of pounds of butter made.

2d. The number of pounds of cheese made.

Section 2. These reports shall be entered by the Secretary in a book kept for that purpose, and shall, with such other reports as he may be able to get from non-members, be compiled for statistical purposes, and be embodied in his annual report, with a view to obtaining as nearly as may be possible, the amounts of butter and cheese produced in this section of country from year to year, the price of which is based upon the regular sales of this association. Reports to be recorded.

RULE XV—VISITORS.

Section 1. Any member has the privilege of introducing a visitor upon the floor of the Exchange, with the understanding that such visitor shall neither solicit nor transact any business. Visitors allowed.

Section 2. The name of such visitor shall be entered upon the register by the member introducing him, and such member shall be responsible for the acts of the party introduced.

Section 3. No visitor may be introduced upon the floor of the Exchange two weeks in succession, and not to exceed twice in the same quarter.

CLASSIFICATION OF BUTTER.

All butter offered upon this Board shall be assumed to be butter churned, salted and packed in a creamery, from cream which is separated from the milk in the creamery where the butter is made, unless otherwise designated. Classification of butter.

Grade for butter.

Extra.—Flavor must be quick, full, fine and fresh; taste must be pleasant and sweet; brine perfectly clear and little of it; body and grain must be perfect; color even and uniform, and good for the market for which the butter is intended; properly salted, neither gritty nor flat; package good and uniform, and not less than five hoops for 60 lb. tub.

CLASSIFICATION OF CHEESE.

Classification of cheese.

A.—Full Creams.—Extras.—Shall be full cream, factory, made perfect in flavor, close-made, fine texture, well cured, uniform color and perfect surface. Boxes to be in good order.

Firsts.—Shall be full cream, factory made, clean flavor, good texture, well cured, uniform color, good condition. Boxes in good order..

Seconds.—Shall be full cream, reasonably clean in flavor for the class in which offered. Boxes in good order.

B.—All other grades of cheese: Quality as understood between buyer and seller.

REGULATIONS FOR THE INSPECTION OF BUTTER.

1st. Any Inspector whenever called upon by a member of this Board in good standing to inspect his butter, shall do so as promptly as is practicable.

Inspector's record.

5th. It shall be the duty of each Inspector to enter in a book, to be provided by the Directors, a true statement of every lot of butter thus inspected by him, giving date, name of owner and factory, number of all packages stamped, and number of packages rejected.

Fees.

Inspectors of this Board called to inspect any butter shall receive from the party against whom his decision is rendered, his traveling expenses and the following fees: For lots of 25 tubs or less, $1, and 2 cents per tub addtional for every tub over 25, if the lots exceed that number.

Appeal from decision.

The party against whom the decision is made by the Inspector, may appeal within 24 hours from such decision to a committee of three members of the Board; one of them to be chosen by the buyer and another by the seller. The two chosen shall elect a third, and from their decision there shall be no appeal.

Fees.

Each member of such committee shall receive his traveling expenses and a fee of $2.00, which together with the costs of original inspection shall be paid by the party against whom the final decision is rendered.

If the establishent of Boards of Trade would, as we believe, raise the standard of Pennsylvania butter, and therefore secure a better price for it, there would still be the question of irregular and uncertain supply to be provided for. At present, one important cause of our uncertain supply is that salesmen, having no regular market for their butter, are tempted to ship where the quotations are highest, leaving any buyers, who might depend upon their products to be disappointed. This reason was given by one dealer to explain why he disliked to handle Pennsylvania goods. We believe with Boards of Trade to provide good markets, this would no longer militate against our products.

Yet there is another cause which needs attention. A large percentage of Pennsylvania creameries are operated only about eight or nine months during the year, that is, during the late spring, summer and fall months. Thus, most of their butter is produced when there is an abundance of it in all markets, and when its price is lowest. By selling at such a time, they lose anything that is to be made from holding it, and by producing through only a part of the year they cannot hold any continuous trade for fresh goods. Fresh goods, the market, and especially the print market, demands, and if home producers will not supply this demand, the market looks elsewhere.

Perhaps the majority of our creameries are not adapted to winter dairying; they could be, however, with a comparatively small outlay.

With creameries fitted for operation throughout the year, and with cows so managed as to distribute their production evenly throughout the year, this second cause of irregular supply would be done away with. The producer could then seek a continuous market for his goods and could secure prices averaging more than those he can obtain at present.

In closing this consideration of our butter interests, the writer wishes to emphasize his strong conviction that, unless more economical methods are adopted in the dairy industry, the outlook is discouraging. One Minnesota authority has stated that butter from that State can be put in the New York market for ten cents a pound. And our competitors are studying their interests from every point of view, while they are, even now, in advance of us in enterprise, technical education and organization. Because they furnish a regular supply of a uniformly superior article, they are catered to by our Eastern dealers, who encourage them in their organizations and butter contests. No Pennsylvania dairyman will admit that it is impossible to produce as good butter in this Commonwealth as in any other. Yet, to produce an article which shall successfully compete with other brands now in our markets will require a great deal of enterprise and energy on his part.

CHEESE.

The development of the cheese industry in Pennsylvania has been very slow, slower than one might expect with our enormous foreign population, the greater part of which is accustomed to cheese as a regular article of diet. During the fifty years, ending 1890, the total amount of cheese made in the State has scarcely more than doubled, while in New York, our greatest competitor in the cheese trade, the amount has nearly trebled. Out of 53 markets in this State, where inquiries were made, only 13 were selling cheese made in this State, which shows that we produce but a small portion of the cheese demanded by our own markets.

Most of the cheese made in this State is made in Crawford, Erie and Potter counties and a large part of the product of these counties is bought by three men, who contract for the entire make of a factory for the season, usually at about ¾ cent below the highest New York quotation. The cheese is delivered when two or three weeks old, stored and shipped, on wholesale orders. One of these buyers ships most of his cheese south and west, the others ship partly to interior points of the State and partly to the New York markets. This system of selling has its advantages for the producer, since in this way he disposes of his entire make at the stated price, whether all the cheese is first class or not. And the cheese made in hot weather, which is not first-class in every respect, brings a much higher price than it would if it were sold in the open market.

The greater part of the cheese made in this State is of medium size, soft, mild in flavor and white in color, and is made for the home trade. New York and Wisconsin cheeses are those with which our product has chiefly to compete. New York cheese has a state brand and an enviable reputation, and on this account, brings ½ cent more than ours. The writer found that of the "fancy" brands, which are sold in considerable quantities in our markets, none were made in this State.

The most popular fancy cheese is undoubtedly the Swiss, which is rapidly growing in favor, especially in the western part of the State. Some dealers claiming to sell as much of this as of the Cheddar. The domestic Swiss, of which as much if not more than of the imported is sold, is made chiefly in N. Y., Wisconsin and Ohio. That from Wisconsin seems to be considered the best, since it resembles the imported more closely than do the others. Of the other fancy brands on our market, perhaps the cream cheese and club house were the favorites, although considerable Edam and Rocquefort were found. A great deal of the fancy cheese sold in our State was found to be brought direct from New York city from wholesale grocers.

Much of the cheese sold in our markets could be produced in the State, beliefs to the contrary notwithstanding. Although the writer believes that the Cheddar cheese industry could be further developed

with profit, there is a strong demand for a small, rich, mild, family cheese. If some such cheese could be made, which would require a moderate amount of apparatus, a short time to manufacture, and which would utilize some of the very cheap milk during the summer months, it would be a boon to dairymen. The demand for such a cheese is waiting to be supplied, and it is so urgent that higher prices would be paid than for ordinary cheese.

The writer knows of no cheese which comes nearer filling this want than the Gouda or a modification of it. This is a cheese weighing, when cured, about nine pounds, is made of whole milk, requires but two hours in its manufacture, but little apparatus, and is cured in a cool cellar. With good milk, but about nine pounds are required for a pound of cured cheese, and for such a cheese the writer has had no difficulty in obtaining the equivalent of 25 cents per pound for butter, at a time when butter was selling for 18 cents at retail. Such a cheese is easily made and is one of the many varieties that doubtless could be developed for the home trade.

It was a matter of some surprise to find that in many cases, the dividends of cheese factories were made by pooling the milk. The fat test, in some places where it had been tried, had been given up as unsatisfactory. This is a fact to be regretted for, as long as the milk is pooled in common, there will not be the inducement to produce a better quality, which means a better cheese, nor will there be the check to skimming, which is done to some extent at the present time.

What has been said of Boards of Trade in connection with our butter trade, will apply with equal force to the cheese industry, where there is any considerable amount to be sold. There is a good number of such boards in New York, where they give satisfaction in disposing of the entire make of cheese. Three Boards of Trade have been in existence since 1871, a fact which gives evidence of their usefulness. There is not a section of New York state, which has large cheese interests, where Dairy Boards of Trade do not exist.

The past season has been comparatively favorable for the cheese makers, and it is quite reasonable to suppose that next year's output will be larger than that of the previus year.

With the present cheese law in force, our cheese should establish a good reputation, which, if maintained will make for it the place it should have in the world's markets. Our cheese industry needs to be fostered, and especially is this true at the present time, for the coming year may be considered, perhaps, as marking an epoch in the history of this industry.

There are various suggestions which it may be well for the cheese makers to consider. One is the matter of color, which, of course, is a difficulty easy to remedy. The writer was informed that while the New York market demands a colored cheese, nearly all the Pennsyl-

vania cheese sent there is white. It seems that the cheese dairymen might get more out of his cows than he now does. It is the prevailing custom in cheese making districts to milk the cows from seven to eight months only and to let them remain idle the remainder of the year. With different management they could be milked two months longer and this milk could be made into butter. Then, instead of having no milk at all, or the lightest production of the whole year, in winter, when milk is worth most, let the cows come in fresh, so that they will be dry, or nearly so in August and September, when flies, drouth and weeds make it very difficult to produce an extra quality of milk. Possibly the greatest need of all is improvement in the cows themselves. A cow giving 6,000 pounds of milk annually, produces much more cheaply than if she gave but 4,000 pounds, and her milk will sell for half as much again.

It should be borne in mind that the chief competitors in our home markets, as well as in the foreign markets, are putting forth their best efforts, and in some cases, with the fostering care of their state or provincial government, and are thus making steady advances in the science and practice of cheese making. In some sections careful attention and study is given to obtain a more complete and satisfactory method of curing cheese; in other sections, the subject of refrigerating is receiving assiduous attention. In fact there are still a great many of the principles involved in cheese making which are imperfectly understood, and until more of them are mastered by our cheese makers, we cannot attain to a high place in the industry.

MISCELLANEOUS DAIRY PRODUCTS.

While milk, butter and cheese are the staple dairy products in our markets, various other forms of dairy goods are marketed, although to a lesser extent. Doubtless the most important of these is ice cream, the demand for which is increasing each year. And yet, so far as the writer could learn, its manufacture has not been reduced to the same system which characterizes the manufacture of our other products. One quart of a fair quality of cream will make about one quart and one-half of ice cream. While the cost depends upon various conditions, under ordinary circumstances, the materials used in one quart of ice cream should cost about 12 cents. This provides that only cream, sugar, flavoring, salt, and ice are used, and that the cream is bought at butter prices. As ordinarily sold this leaves as great a profit for the manufacturers as he could get for the milk and cream sold in any other form.

The process of manufacturing and preparing for wholesale or retail custom is not difficult to master, and creameries located on a main line of a railroad, within a few hours run of a city, should find a very profitable market for this product. An outfit is not expensive and

does not require much room, and the making of a large order of cream requires no more than one or two hours.

Hence it will be seen that where a trade for ice cream can be found at no great distance from its place of manufacture, there should be considerable profit in the business conducted on a wholesale scale.

Various other dairy products, such as koumiss, matzoon, condensed milk, malted milk, modified milk, etc., are found on the market. While they are not specially in the line of the dairyman proper, they are, in some cases, a considerable source of profit to those who furnish milk for their manufacture. So far as the writer could learn, none of these products were made in this State. Since they are made in other states with some degree of profit, it is reasonable to assume that the man with proper training and business ability could establish a profitable business of this sort in our own State.

THE CULTIVATION OF AMERICAN GINSENG IN PENNSYLVANIA.

By PROF. GEORGE C. BUTZ. *Assistant Horticulturist Experiment Station, State College, Penna.*

It is very probable that every county in Pennsylvania has been hunted over for ginseng and that now there are from two to twenty more or less active ginseng collectors in each county of this State. The practice of collecting the roots during the summer months before the crop of seed has ripened, and of taking every root in sight, however small, has very naturally resulted in greatly diminishing the quantity of wild root available for exportation; and, though the price per pound has steadily increased as the supply of root decreased, yet the profits to the collector have not been as great as formerly, owing to the greater difficulty in finding choice roots. In consequence of these conditions the attention of many collectors and other persons having favorable grounds is being directed toward the cultivation of ginseng, in the hope of more profitable returns from such efforts. Ginseng has been cultivated for many years in China and Korea, but in this country it has been within the past 15 years that earnest attempts have been made to cultivate our native species. Though some growers have claimed success in the cultivation of ginseng for five years or more, yet others who have attempted it testify by their experience that it is impossible to grow our ginseng to maturity with profit.

Some Extracts from the Controversy.

In the "Druggists' Bulletin" for December, 1888, appears an interesting article upon the American Ginseng root, stating that the maximum export of 600,000 pounds was reached in 1860 and since this time has gradually diminished; that it is only a question of time when the ginseng will be exterminated, and that various attempts have been made to cultivate ginseng, especially in New York, Pennsylvania and Wisconsin, but no satisfactory results have yet been reached.

In the "American Agriculturist" for December, 1890, p. 645, Mr. A. S. Fuller, writing upon the cultivation of ginseng, gives excellent directions for forest beds, and says:

"It appears to thrive best in loamy soils, such as are usually found in sugar maple and oak forests at the North. Shade seems also to be essential, for when the plants are exposed to the direct rays of the sun they die out, and for this reason open field or garden cultivation of the plants has rarely or never been attended with success. The proper way to start a plantation is to select a piece of land at the edge of some forest where the plants are found growing wild."

Mr. L. Greenlee, of Garden City, North Carolina, writes in the American Garden, Vol. 12, p. 381, 1891, making the following statements:

"The great demand and high prices paid for dry roots of our little native plant (Ginseng), have led to much inquiry concerning its cultivation and history * * * It grows in loamy soils along elevated plateaus, or near the sea level in Northern states. With us it is peculiar to mountain sections, and so far has not proved amenable to culture."

In "Garden & Forest," Vol. V, p. 223, 1892, Geo. Stanton, of Summit Station, Onondago county, N. Y., first declared his success in the cultivation of ginseng in the following manner:

"It is the general opinion in this country that the plant cannot be successfully cultivated. In 1891, while attending the State fair at Syracuse with an exhibit of Ginseng, I was told by more than a hundred people that they had tried to cultivate the plant by setting roots and sowing the seed, but that they never grew. And this was my own experience at first. My first sowing of seed did not produce a plant. Two hundred roots which I put into the ground in 1886 made little growth the first year, and the outlook was so unfavorable that I abandoned the business. In 1887, I put in some roots and sowed some seeds, and the next year my plants made a better showing. I then commenced to study the habits and characteristics of the plant, and, with the experience gained, my success has been complete. I had thousands of fine plants growing on my ground in 1891. Many roots can be grown in a small space, and although the growth on each one during the season is small, yet the aggregate is considerable. The plant will grow much more rapidly under cultivation than it will wild, and it therefore seems destined to become an important agricul-

tural product * * * There is a general impression that our Ginseng may be grown in the forest, but that it cannot be successfully cultivated in the open garden or field. Of course the forest is the natural home and when it is once established in the woods it will require but little care or attention * * * My own operations have been in the open garden. Small roots may be set three inches each way, and seed may be started much closer and transplanted in two or three years. Experience will show the best method of shading. I have found that shade of some kind is essential. All that is needed then is weeding and careful cultivation * * * Of course there is much to be learned as to the best method of planting and cultivation, but the cultivated root is firmer and shrinks less in drying than the wild article. In my opinion, the growing of the plant can be made profitable, even if the root does not bring more than $2.00 a pound."

Efforts have been made from time to time to establish the Corean Ginseng plant at the Royal Gardens at Kew. In 1892 some seeds were obtained with great difficulty by Walter C. Hillier, Her Majesty's Consul General in Corea, from the large Government Gardens at Songdo, and sent to the Kew Gardens with the following hints as to cultivation, gleaned from the Coreans: "The seeds are sown in the spring in beds of fine leaf mould, no manure being used. The beds are raised about a foot and a half, are protected from the north winds, and screened at night with mats, an awning of mats being placed over the beds during the fierce heat of summer. At the end of the first year the plants are set out, and it takes five or six years for them to reach maturity."

In 1893, Mr. Greenlee, previously cited, wrote that in North Carolina ginseng "is now being successfully cultivated in the edges of forests partially cleared."

At the close of 1894 the U. S. Department of Agriculture published a bulletin (No. 16, Division of Botany), summing up the history and cultivation of American ginseng, by Geo. V. Nash.

Prof. F. V. Coville, botanist, in his letter of transmittal, says:

"The report points out the fact that the natural supply is now rapidly decreasing, and that its extermination, if present conditions continue, is inevitable. At the same time there can be no question but that the cultivation of Ginseng is entirely practicable, and this information on the subject of cultivating the plant is therefore submitted to those interested. The ultimate success of Ginseng culture must, however, depend upon the result of a commercial test, having in view the possibility of overstocking the market through a widely increased source of production."

Many persons seem to have undertaken the cultivation of the plant with brief instructions and no experience, and perhaps lacking the necessary patience, but most of them have failed in their first attempt and occasionally have reported through periodicals that it is impracticable to grow ginseng for a crop. To show that success can be and has been attained the following figures, which appeared in "American Gardening" in February, 1896, are cited. They show the value of a ginseng garden after eight years of successful culture by Geo. Stanton:

"Up to autumn of 1888 I had only about 250 plants growing in my garden. I have now (January, 1896,) 67 beds,

30 beds 3 x16 feet, each,

37 beds 3½x16 feet, each,

stocked with roots in garden, and about 15,000 seedling roots in forest nursery. Also about 10,000 seeds sown in forest beds, from which plants are expected next spring. And this past season's crop of seeds, about 200,000, on hand, ready to be sown next fall to produce plants in spring of 1897. I have also, during the past five years, furnished the public with about 80,000 seeds and 4,333 roots for cultivation. The total product of dry marketable root from my ground up to the present time has been 84½ pounds, which sold for $405.88. I sold 28 pounds of the past season's crop at $5.50 a pound. The total cash product from seven and a half beds, 3x16 feet, taken up last fall was:

For dried root,	$186 00
The value of 4,232 roots for replanting,	126 96
The value of seed crop for four years,	75 00
Total value,	$387 96

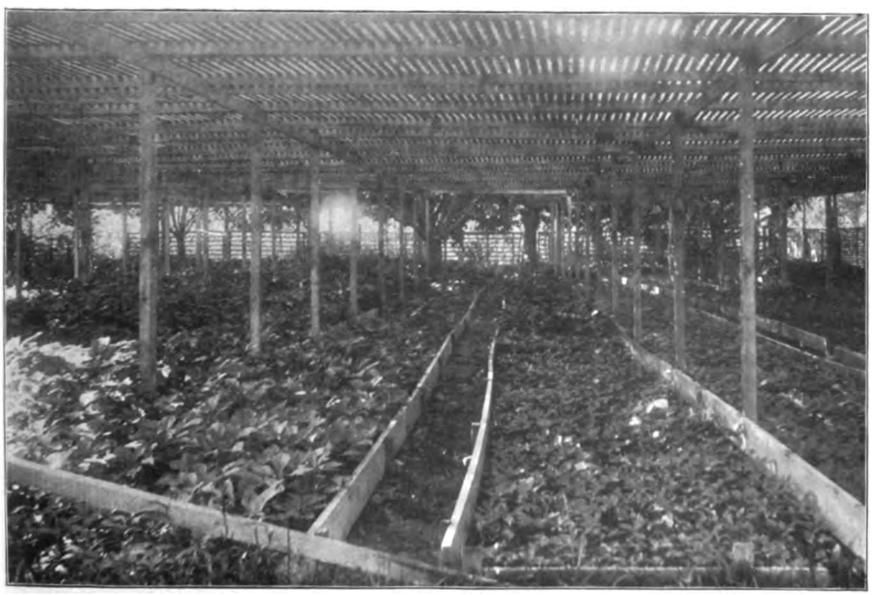
This is for less than two square rods of ground in less than five years, four beds having been in cultivation five years, the others four years. * * * * The price for the past few years has ranged from $3 to $4 per pound for first class wild root in New York."

The writer visited Mr. Stanton's ginseng garden and his forest nursery beds in August, 1897, and witnessed the present condition of his stock. The seed beds were a charming sight because of the very uniform size and healthy color of over 100,000 seedlings from the sowing of the previous fall, proving conclusively to the writer's mind that ginseng plants can be successfully grown from seed. In other beds of the forest were plants two and three years old in good condition. In the garden plot the beds referred to above were covered with a luxuriant growth of ginseng plants with stems more vigorous than can be found in the wild state and bearing heavy heads of fruit.

What is Ginseng?

Ginseng, in this country, is a native perennial plant having a thick, fleshy root somewhat resembling a carrot. In the Southern states the common name has been corrupted and contracted into "sang," and in the North to "sheng." Lindley, in "The Vegetable Kingdom," gives the spelling as ginseng or ginschen. The American ginseng is *Panax quinquefolium*, L. Botanists have not agreed upon a specific distinction between the American and Chinese plants. Lindley says of the Chinese plant that it "belongs to some species of Panax

GINSENG.—Forest seed-beds with 100,000 seedlings.



GINSENG.—Lattice shading for Ginseng beds.

(P. Ginsing, MEYER*)* unknown. It was formerly supposed to belong to *Panax quinque folium* but that seems to have been a mistake; the species so named is said, however, to be sold by the Americans to the Chinese as a substitute for their ginseng." Hooker refers the Chinese plant to *Panax Ginseng*. Loudon's Encyclopedia of Plants says: "*P. quinquefolium* is a native of Chinese Tartary and also of North America."

Gray follows Decaisne and Planchon in the use of the name *Aralia quinquefolia*, for the American plant. A note in the *Official Guide*" to the Museums of Economic Botany at Kew, p. 87, concerning ginseng is as follows: "Ginseng—The root of *Aralia quinquefolia* A. Gray, Var. ginseng, Reg. et Maack, is a native of North China."

Britton & Brown, in "Illustrated Flora," 1897, refer it back to the older name Panax quinquefolium. Dr. Britton writes me the Chinese plant is recognized as a distinct species under the name P. Schinseng, Nees.

Prof. S. C. Sargent, in his notes on the Forest Flora of Japan, regards the Chinese plant as *Aralia quinquefolia* and as being identical with the American plant. He says: "Aralia is more multiplied in species in Eastern America, where six are known, than in Japan, whose flora contains only two, although a third, the ginseng *(Aralia quinquefolia)* a native of Manchuria, Northern China, and the United States, has been cultivated for centuries in Japan for the roots, which the Chinese esteem for medicine and buy in large quantities, sometimes paying fabulous prices for them, especially for the wild Manchurian roots, which are considered more valuable than those obtained from North America or from plants cultivated in Japan or Corea, where ginseng cultivation is one of the most important branches of agriculture."

DESCRIPTION OF THE PLANT.

Panax quinquefolium belongs to the small order of *Araliaceae* or ginseng family of plants, in which are included the common wild sarsaparilla, spikenard and the groundnut or dwarf ginseng. There is considerable resemblance between members of this family and such plants as the carrot and parsnip, in the thickened roots, flowers in umbels, and compound leaves.

The seedling plant has three simple leaves in a whorl at the top of a stem rising one to two inches above ground. The mature or fruiting plant throws up its single stem 8 to 15 inches, about as thick as a lead pencil. At the top are three, four or five compound leaves in a whorl, each resembling a leaf of the horse chestnut. The number of leaflets is usually five, hence the specific name *quinquefolium* but on young or weak plants it may be only three, and on old or vigorous plants it is often seven. The two leaflets at the base of the digitate arrangement are about two inches long, but the rest

of the leaflets are 4 to 7 inches long. They are egg-shape, with broad end farthest from the stem, with serrated margins and an

Fig. 1—A strong Wild Plant; [Portion above ground].

acuminate apex, all of which is well illustrated in the annexed cut. From the centre of the whorl of leaves the stem of the plant is continued upward as an erect flower stalk from two to eight inches

Fig. 2—Fresh Wild Root.

long, according to the thriftiness of the plant, and in July it bears a cluster of from 10 to 50 small yellowish green flowers arranged in an umbel. These flowers are succeeded by fruits like flattened berries of a green color until August, when they become consecutively purple, red and finally scarlet when fully ripe about September first. The berries are about the size of peas and contain two or sometimes

three seeds; the pulp of the berry is edible, tasting somewhat like the root.

The entire growth of the plant above ground is annual, while the underground portion is perennial. The portion underground consists of two parts, the rootstock or rhizome, and the root proper. The rootstock is slender, not fleshy, bearing the scars of the previous year's annual growth. Each scar, therefore, represents a year in the age of the plant. At Mr. Geo. Stanton's place the writer saw dried rootstocks which had been gathered in the forests, bearing 65 such scars, though the root appended was no larger than one's little finger. Roots, however, may be as large as they are known to occur and yet bear upon their rootstock not more than 8 or 10 scars. The original root of the plant is at the base of the rootstock, but roots may be produced in after years from points higher up on the rootstock, as in Fig. 2.

Mr. Chas. C. Lindley, of North Carolina, reports ("American Gardening," February 22. 1896), that the crown (rhizome) of the plant cut off one inch long and planted again, produced seed the next season.

The root proper is the part which has commercial value. The seedling roots, resemble small parsnips, being long, cone shaped, fleshy, white roots, free from branches or rootlets, except at the very base. It is common to find roots forked at the middle, giving an appearance that is suggestive of the human body with legs attached, and rarely specimens with arms in addition, as in Fig. 3, are found. It is this man-like form that is regarded by the Chinese with a sort of reverence and is said to be "worth its weight in gold." The name ginseng signifies "man-plant," and is applied because of the frequency of these forked roots and their fancied resemblance to the human form. Under cultivation, the roots being transplanted several times, become shorter and thicker, with many fibrous roots to feed, thus hastening the enlargement of the body of the root. The size of roots collected varies in length from 3 inches to 12 inches; in diameter at the thickest part from one-fourth to one and one-half inches, and in weight from one-eighth of an ounce to eight ounces. The very large roots, however, are now exceedingly rare. The root is marked with

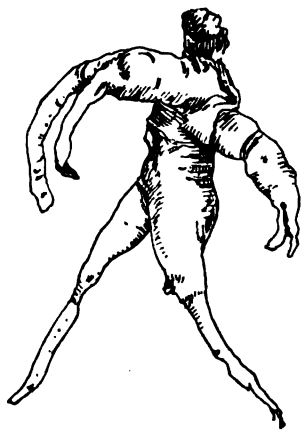
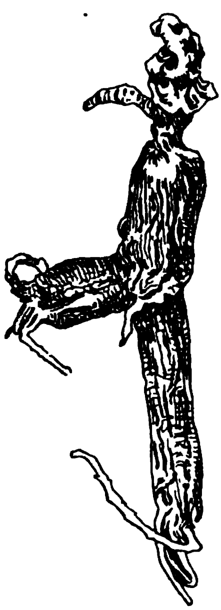


Fig. 3—Wild root; [Human form].



led].

transverse wrinkles when fresh; the dried root shows longitudinal wrinkles, due to shrinkage, Fig. 4.

The new growth of spring does not make its appearance above ground in Pennsylvania until the last week in April, and one month later the whole leaf system is fully expanded. The flowers open in June and July, and the berries are ripe by the middle of August. The only method by which ginseng can be propagated is by seed. Therefore it is plain to be seen how effective is the prevailing custom of gathering roots in the summer before the seed crop has ripened, in diminishing the annual exportation.

The American ginseng is found growing in this country over a triangle of territory with its angles in the states of Maine, Minnesota and Alabama, confining itself, however, to the mountainous portions of the states south of Pennsylvania. It was first discovered near Montreal, Canada, in 1716, by Father Laftau, a missionary among the Iriquois Indians. About this time Father Jartoux, a missionary in China sent a description of the Chinese plant to Europe and an eager search was made in other countries for a ginseng plant, resulting in the discovery in Canada. The French soon after began collecting it for export to China, and, according to the researches of Geo. V. Nash (Bulletin 16, Div. Bot., U. S. Dept. Agr.), "In 1750 it was found in the western parts of New England generally, and in 1751 it was discovered in central New York, and at Stockbridge, Mass. It was found plentifully in Vermont at the time of the settlement of that State, and the parties who dug the root sold it in its crude form for about 2 shillings, or 34 cents per pound. As population moved westward ginseng was met in abundance as far as the first tier of states beyond the Mississippi. An export trade was eventually developed which in Wisconsin was reported to have reached a value of $40,000 in 1858 and $80,000 is 1859." At present the chief sources of the plant in the states are Ohio, West Virginia and Minnesota.

Ginseng is now scarce in Canada and also in many of the states where it formerly abounded. Reports from collectors in Pennsylvania indicate that it cannot be found in many of the particular places where it was formerly collected. It occurs mostly in hard wood forests, upon well drained soils, where beech, sugar maple and basswood abound.

The roots from the Northern states command higher prices than those from the Southern states. In a circular issued in August, 1897, by J. L. Cilley, an exporter of ginseng, located in New York city, No. 101 Gold street, the dried root from the several states were rated in prices which he advertised to pay as follows:

1. New York, Northern Pennsylvania, Vermont and Canada, ...$3 10—$3 20

2. Southern Pennsylvania, Michigan, Northern Ohio, Northern Indiana and Western Illinois,	2 90— 3 00
3. Wisconsin, Iowa, Minnesota and Northwestern,	2 70— 2 80
4. West Virginia, Southern Ohio, Southern Indiana, Southern Illinois,	2 60— 2 75
5. Maryland, Virginia and North Carolina,	2 60— 2 70
6. Missouri, Arkansas,	2 60— 2 70
7. Alabama, Kentucky, Tennessee, Georgia,	2 50— 2 60

Medicinal Properties.

The American ginseng root has no medicinal value in the United States. It occurs in some of the editions of the U. S. Pharmacopoeia, but not in recent years, and has never really been used in American practice. It is also stated that it is not employed in the secret remedy industry, which consumes a large portion of our crude drugs. The Chinese, however, regard ginseng as a panacea, which fact is observed in the generic name of the plant (Panax). It is stated that one of the presents given Li Hung Chang, the distinguished Viceroy of the Chinese Empire, during his recent visit to New York, was a collection of ginseng roots, and it is doubtful whether anything he received pleased him more than this. That the price which the Chinaman will pay for the roots depends upon their shape is an indication that the medicinal properties are more imaginary than real. Ginseng is used in China as a remedy for all weakness of body or mind; for pituitous humors, for weakness of the lungs, to stop vomiting, to strengthen the stomach and aid digestion, and it is believed that it prolongs life in old age.

The root has a slight aromatic taste, resembling that of the licorice root, and like it is somewhat demulcent and stimulative. The drug is prepared as an extract or a decoction, and administered in pills, confections or infusions. It does not seem probable that the Chinaman's faith in the efficacy of ginseng will wane for some time to come, and consequently the demand for the American root will continue steadfast. It was said by a traveler in China that he never entered a drug shop but ginseng was being sold.

Commercial Value.

The price paid for ginseng in this country has steadily increased from the first consignment made in the early part of the eighteenth century, on which exporters realized 34 cents per pound. In 1832 the shipment of ginseng from the United States amounted to 407,067 pounds, valued at $99,303. The extent of the industry in the United States since 1858 and the average price paid for the dried root at the ports are illustrated in the following table of figures taken from the Bulletin by G. V. Nash, with the addition of subsequent years.

EXPORTS OF GINSENG FROM THE UNITED STATES FROM 1858 TO 1896.

Year.	Total pounds.	Average price per pound.	Total amount.
1858,	366,053	$0 52	$193,736
1859,	110,426	49	54,204
1860,	395,909	74	295,766
1861,	347,577	84	292,899
1862,	630,714	64	408,590
1863,	372,945	79	295,120
1864,	360,950	1 31	474,920
1865,	464,507	1 17	547,653
1866,	444,398	86	382,870
1867,	479,974	1 11	535,883
1868,	370,066	1 02	380,454
1869,	282,405	1 02	288,054
1870,	474,310	95	455,097
1871,	114,221	1 04	119,385
1872,	401,260	85	341,616
1873,	350,141	97	341,144
1874,	400,619	1 12	448,760
1875,	497,487	1 32	658,926
1876,	550,624	1 17	646,954
1877,	440,406	1 32	562,268
1878,	421,395	1 18	497,247
1879,	391,264	1 24	465,611
1880,	391,083	1 36	533,042
1881,	338,841	1 65	561,545
1882,	262,728	1 83	483,171
1883,	414,023	2 04	848,393
1884,	295,242	2 08	614,995
1885,	377,345	1 99	751,168
1886,	467,608	2 13	998,332
1887,	330,831	2 08	689,735
1888,	308,365	2 13	657,358
1889,	271,228	2 33	634,091
1890,	223,113	2 71	605,233
1891,	283,000	3 39	959,992
1892,	228,916	3 51	803,529
1893,	251,205	3 15	792,928
1894,	194,564	3 18	619,114
1895,	233,236	3 97	826,713
1896,	199,436	3 86	770,673
Total, 39 years,	13,738,415	$1 52	$20,837,169

This takes no account of the ginseng exported annually from Canada. The quantity sent out of that country in 1890 has been estimated as worth $100,000.

RECAPITULATION, SHOWING ADVANCE IN PRICE.

	Total pounds.	Average price per pound.	Total amount.
Exports for 10 years, 1858-1867, ...	3,973,453	$0 89	$3,481,641
Exports for 10 years, 1868-1877, ...	3,881,539	1 09	4,242,658
Exports for 10 years, 1878-1887, ...	3,690,360	1 75	6,443,239
Exports for 9 years, 1888-1896, ...	2,193,063	3 04	6,669,631

The perceptible increase in the price per pound indicates a growing market in which the supply is decidedly inadequate to the demand.

The American ginseng is not regarded by the Chinese as being as valuable as their own roots. Five grades of ginseng are described by I. F. Shephard in the United States Consular Reports, 1884.

First. "Imperial ginseng" is that raised or gathered under imperial protection in the parks or hunting grounds, where it is kept free from the profanation of the vulgar herd. It ranges from $40 to $200 per pound.

Second. Korean ginseng is regarded as second best in quality, and includes both the wild and cultivated root of that country. The price of this is $15 to $35 per pound.

Third. Native ginseng is that grown in China near the borders of Korea. It is valued at from $1 to $10 per pound.

Fourth. American ginseng stands next in the estimation of the Chinese; when crude it averages (1884) about $2 per pound.

Fifth. Japanese ginseng is the last and poorest quality. This and the "native ginseng" are used chiefly to adulterate the Korean article. It is valued from $1 to $10 per pound.

Since this classification was made the demand for American ginseng has greatly increased in China.

The following is taken from the annual report of Consul Johnson, dated Amoy, China, July 29, 1897:

"I do not exaggerate when I state that it is possible to market annually in China $20,000,000 worth of these roots. They are now being

cultivated in the United States to a limited extent, and prices obtained by the grower are entirely out of proportion to those realized by the thrifty exporter. It sells in Amoy at a price from $25 to $35 (Mexican) per pound. It costs in American from $2 to $3 in gold or $4 to $6 in Mexican currency. Yet at these figures Amoy handled, during 1896, 109,823 kaikwan teals' (or $88,517.34 in United States gold) worth of these roots from America alone. From Korea the value of 54,867 kaikwan teals, or $44,222.80 (United States gold), was imported. The Korean article is much higher priced and more skillfully cured, although not otherwise superior in quality to the American product."

Cultivation.

Since the earliest report of the success attained in the cultivation of the American ginseng by Mr. Geo. Stanton, who might be regarded as the pioneer in the movement to cultivate this remarkable plant in America, there have been many persons in the state of Pennsylvania who have attempted to follow in his footsteps. Not all have succeeded; perhaps because the necessary amount of attention was not bestowed upon the plants. One of the most successful cultivators in this State is Mr. N. B. Curstead, Oliphant Furnace, Pa. He has had plants under cultivation for 8 years, in a plot of ground about 10 feet by 50 feet, in the rear of his garden; a line of large native trees stands upon the southern border of the plot and the spreading branches shade the beds of ginseng all the day. Mr. Curstead has now in his bed many marketable roots and is making preparations for an extension of his plantings. Mr. A. B. Null, of Bonview, Lancaster county, Pa., has been a collector of ginseng for ten years and writes: "I have cultivated it four years and grow plants from seed for planting." Mr. Null has not yet planted extensively for a crop of roots but is growing and collecting stock to plant new beds.

Mr. James Galen, Bethesda, Lancaster county, has been a collector for many years, and being thoroughly acquainted with the habits of the ginseng plant, has succeeded in maintaining limited plantings in his garden.

Mr. Jno. O. Rosser, Mill Hall, Clinton county, Pa., obtained plants and instructions from Mr. Geo. Stanton in September, 1892, and writes, August 30, 1897, of his experience as follows: "In reply to your inquiry, would say that my experience has been limited and resources meagre, but four years ago I started with some 40 plants; from them I now have about 400. I would not hesitate to say that had I the means to prepare for ginseng culture, I would make it both profitable and pleasant. As yet I have endeavored only to increase the number of plants, but from surface indications believe that I have single roots that will weigh 4 ounces green."

Dr. James Johnston, of Bradford, Pa., teaches by his experience

that ginseng cannot be grown without more or less constant care. He writes, under date of September 23, 1897: "We made a bed in an obscure corner on a side hill and planted seeds for two seasons (1891 and 1892). The first lot came up on time and promised well, but after that there were only a few desultory showings. My test was not a fair one because the beds were almost unattended and were exposed to unusual drouth in the third year, then to unusual rains in the fourth year, which washed earth down so as to cover them up completely. * * * I would be willing to try again, and think I shall try in my town garden this time and give it more care."

J. W. Drake, Saegertown, Crawford county, Pa., writes that with but two years' experience he is of the opinion that ginseng can be grown in this State with profit.

Mr. Geo. Stanton, of Summit Station, Onondago county, N. Y., has cultivated ginseng for 10 years. He has made a success of it, for in his grounds are the most thrifty and healthy plants by the thousands and tens of thousands of all sizes. He has made it profitable, as his carefully kept account of expenditures and receipts shows, although his beds have only recently begun to yield marketable roots. He discovered for himself, by his own experience, that it required 18 months for the seed to germinate. He has demonstrated that the plant can be grown in any garden with proper shading, and with patience and thought has worked out the most successful construction to provide such shade. Frequent reference to his work is made in these pages, though his ginseng farm lies somewhat beyond the border of Pennsylvania, in the State of New York. Mr. Stanton has chosen to call his place the "Chinese Ginseng Farm," but it is the true American species which he is cultivating for the Chinese market. He is very willing to receive visitors at his grounds and solicits correspondence upon the subject of ginseng.

Propagation.

Ginseng plants can be multiplied only by means of seeds. These are taken from the plants when ripe in September; each berry contains two, sometimes three seeds. It requires 18 months for ginseng seed to germinate and during all that time it must not be allowed to dry. Therefore, it cannot be stored as vegetable seeds are in packages, but must be treated as most forest seeds are, by stratifying during the period of germination. Many failures with ginseng seed have occurred because of the lack of exact knowledge on this point. The seed may be sown as soon as ripe in beds prepared for them, but should be covered with muck, leaf-mold, or some kind of mulching to prevent baking or cracking of the soil. It is further advisable to place a lot of brush over the mulch until the spring when the seeds are expected to sprout.

The seed may be preserved during the first twelve months by stratification; that is, by mixing it with four times its bulk of well decayed leaf-mould, and storing in a small wooden box; or, by putting the leaf-mould one-half inch thick over the bottom of the box, then a single layer of seed, then another course over the first, alternating soil with seeds until the box is nearly full or the seed all stored. The box containing the seed must then be placed where it will not be neglected. It must be protected against mice and excessive drying. Mr. Stanton tacks over the top of the box a sheet of tin, perforated to admit rain. The box is then placed in a shaded place where it can remain all winter and summer.

The seed beds should be carefully prepared. The best place is in a forest where there are tall trees with little undergrowth and the soil is light, loose and rich. It should be carefully forked ten inches deep, removing all roots that wou'd interfere with the growth of the young ginseng plants; all stones should be taken out. A liberal amount of leaf-mould may be used to give the desired looseness to the soil. If there is danger of flooding and washing in the spot chosen, the objection can be avoided by raising the seed beds, retaining the soil by boards 6 inches wide at the sides and ends, held in position by stakes. A convenient size for seed beds is 3x16 feet. A bed 3x4 feet is large enough for 1 ounce of seed. An ounce contains about 500 seeds. Sow the seed in drills one inch deep, making them two or three inches apart and dropping the seeds one inch apart in the drill. Forest beds must be protected against animals grazing and tramping over them. Cattle are very fond of the leaves of ginseng.

If a forest bed is not convenient, a seed bed can be made in an orchard or even the open garden, if satisfactory shading is provided. Shade is essential to ginseng throughout its whole period of growth.

After the seed is in the ground and covered, the bed will require no special care beyond that of keeping out weeds, never permitting them to interfere with the perfect development of the ginseng plants. The seedlings are allowed to remain in the seed beds two or three years before transplanting into permanent beds.

Seeds are sometimes sown between the rows of plants in permanent beds, thus economizing space and shading, but the practice is not to be recommended for first class seedlings.

Permanent Beds.

Permanent beds are prepared in the same manner as described for seed beds. The general condition of the soil should be somewhat firmer or closer than that recommended for seedlings. Some permanent beds in this State have too strong an admixture of leaf-mould to sustain vigor in the plants. There should be considerable body

to the soil, as in a rich friable garden loam. If cultivators will examine carefully the condition and character of the soil in which vigorous ginseng plants are growing in their native haunts they will discover that the hand cannot be thrust down to the depth of the roots; neither is the soil a pure black mould, as some beds have unfortunately been made.

The permanent beds are planted with two or three year-old seedlings, or with small wild roots gathered from the forests. The latter, when near at hand, are more cheaply obtained than cultivated seedlings, but it is reasonable to believe that seedlings grown under conditions best suited to their rapid and uniform development, and provided with many fibrous roots, will transplant with less loss and resume growth with a more rapid pace than wild roots stunted by the various disadvantages which wild plants must endure, carrying a minimum of working rootlets. Occasionally very good wild roots can be found and of course should not be discarded.

In the permanent beds the plants are set from 4 to 6 inches apart each way, and are not again moved until ready for market. This will be in four or five years from transplanting, or six to eight years from seed. The handling of plants for transplanting is best done in September or October, although it may be performed successfully in early spring. The roots may be dibbled in or set in an opened furrow deep enough so that the last "scar," or rather the new bud for the next season's growth on the rootstock may be covered about two or three inches. There should be no cutting or trimming at the roots. After the roots are set in the permanent beds the most important consideration to success is proper shading, which must be provided before the warm days of spring arrive. To protect the roots in the ground during winter a good mulch of forest leaves (or straw) and brush is thrown over them.

Artificial Shading.

Many of the failures in ginseng culture have resulted from the full exposure of the beds to direct sunlight or by shading in such a manner that free circulation of air was obstructed and the plants could not thrive. Mr. Stanton began by having lath screens over the beds just a little higher than the plants in them. The effect, however, was unsatisfactory and it was necessary to remove the screens whenever the beds required any work. His present arrangement, which he regards as the most successful manner of shading beds of ginseng in garden culture is illustrated in Fig. 8. It consists of a flat roof of lath screens raised high enough above ground to admit of easy walking underneath. It is much like a screen house built by florists and gardeners in which they summer potted plants which cannot endure the full sunlight.

Mr. Stanton's ginseng houses are constructed so that the entire roof can be removed at the approach of winter with its snow, and stored until spring. Only the supporting frame work remains standing. The uprights are 8 feet long, of 2x4 inch stuff, planted 2 feet in the ground, and stand 6 feet apart in rows which are 8 feet apart, admitting between them a bed of 3 feet wide on either side of a 15-inch walk. At the top these uprights are held in place by cross pieces of 1x3 inch stuff running in two directions. On these cross pieces the screens of lath rest and are made fast to prevent their being disturbed by severe winds. Ordinary plaster lath may be used for the screens, leaving five-eighth inch space between the lath. The sides of the enclosure are also of screens to the height of three feet, thus leaving the upper half of all the sides open, whereby the free circulation of air may take place. According to Geo. V. Nash, a ginseng grower of Somerset, Ky., Mr. J. W. Sears, planted permanent beds in a "rich north hillside, well timbered," and "in the spring frames are placed over them on which a lot of brush is thrown," thus providing a cheap shading, though less perfect.

The height of the brush above the plants is an important item, but is not stated.

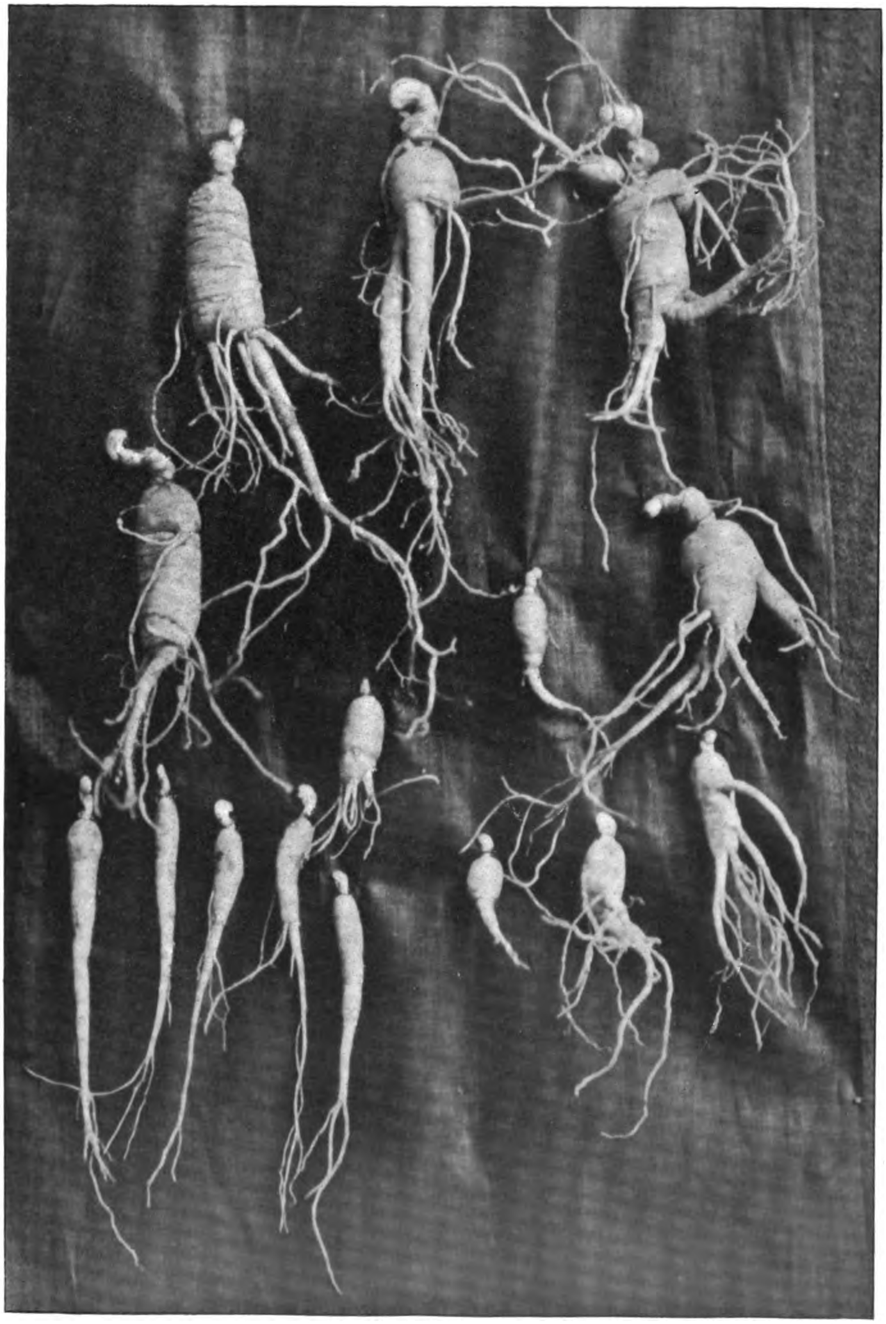
Treatment of the Beds.

The beds, when planted and shaded, require but little attention, aside from the weeding during summer, and being on the lookout for the enemies of the plant. Snails and some insects attack the young plants to some extent. Some roots are injured by worms. Field mice or ground moles have been suspected of eating off the young roots of seedlings in forest beds, and some evidence of a fungous disease causing a decay of maturing roots has attracted some attention. Experience has been too brief to determine whether these annoyances will be constant or prove to be only incidental.

In the month of September the seed crop is harvested and stored, and at the approach of heavy snows the shading screens are stored for winter. What use might be profitably made with fertilizers has not been made a matter of experiment in this country, except to employ well rotted horse manure instead of leaf-mould in the preparation of permanent beds.

The Cultivated Root.

Under cultivation the roots of ginseng develop more fibrous roots, which serve to mature the tap roots in the fewest possible years. Six to eight years from seed will make the choicest roots, or four to five years from two or three year old seedlings transplanted. Mr. Stanton marketed his first roots in 1893, and sold the crop of 16½ pounds to T. A. Bronson, of New York, at $4.00 per pound, or 50 cents per



GINSENG.—Cultivated Roots, 2, 3 and 4 years old.

pound more than the wild root was sold for at that time, and received in reply from Mr. Bronson that he would like 1,000 pounds of such roots. These roots, 241 in number, averaged in weight, when fresh, $3\frac{1}{2}$ ounces, and the largest of them weighed $6\frac{1}{2}$ ounces. Such roots are rarely found now among the collection of wild root. In 1895, Mr. Stanton received $5.50 per pound for his cultivated root.

Valuable pioneer work can be done to establish a strain of ginseng that will be noted for its large fleshy roots developed in the minimum of time. The seed from the largest and best roots should be kept separate from the general crop and sown where they could receive special care and treatment, and when the plants reach maturity repeat the careful selection of seed and thus continue through several generations or until a distinct strain of plants is established. The history of the cultivated carrot and other fleshy rooted vegetables of cultivation indicates that a similar selection has been going on, though less persistently, to bring about the great differences between the cultivated and native forms.

Preparation of the Root.

After the roots are carefully taken out of the ground they should be washed clean with water and a broom or brush. No previous trimming of rootlets or rootstocks is necessary, for after drying the small roots are broken off in the handling and the rootstock serves to indicate the age and possesses the same qualities as the root. In fact, mutilated roots, or such as have been cut or sliced to hasten drying, are rated inferior to whole roots. When the roots are thoroughly cleansed, they are dried by laying them out loosely over a tray or trays and exposed to the sun, or subjected to a moderate artificial heat. There is danger of scalding or burning them and this should be avoided. The quicker the drying is effected, the better will be the appearance of the root. It requires ordinarily about one month to be completely dried, and during this process the root loses about two-thirds its weight, three pounds of fresh root making one pound of dried root. It is said that roots gathered in the summer lose three-fourths of their original weight in drying, although in several trials with roots gathered on July 3, 1897, the shrinkage was just about two-thirds. The cultivated root does not shrink so much. Three native roots collected July 3 were weighed at intervals during the process of drying, which was conducted in the sun, and gave the following figures, the weights being in grammes:

	Root 1.	Root 2.	Root 3.
July 3, fresh,	63	32.5	15.7
July 6,	45.7	22.7	11.4
July 10,	32.3	13.6	7
July 19,	23.1	12.1	6.2
July 29,	21	11.8	6.1
August 5,	20.9	11.7	6.1

When roots are thoroughly dry they are placed in paper sacks or clean boxes and kept away from dust until a shipment can be made to the wholesale buyer.

Protection of the Wild Root.

The collecting of the native ginseng is a sort of pilfering that has seldom been prohibited by the owners of the forests in which the roots are gathered. Nicolas Pike, in an interesting article on ginseng (Scientific American, January 10, 1891), writes that in New York, back of the Catskills, is a forest extending over twenty miles, and there ginseng grows in great abundance, and thousands of pounds are yearly gathered by the poor people of the county, that the "whole population in the neighborhood, men, women and children, turn out 'ginsening,' as they term it."

In view of the rapid extermination of the root, a few states have enacted laws limiting the time of collecting, so that all seeds would have ripened before the plants are disturbed. Such laws, however, are difficult to enforce, and yet they direct the attention of thoughtful men to the wasteful method of collecting now in vogue.

In Virginia, as early as 1875, the Legislature enacted: "If any person shall dig any ginseng from the fifteenth day of March till the 15th day of September, such person, on conviction before a justice of the peace, shall be fined not less than five nor more than ten dollars and costs for each offense." The informant is entitled to one-half the fine, the remaining half going to the Commonwealth.

Ontario, Canada, has a similar law since 1891, making the period of restriction from January 1 to September 1.

West Virginia has a law to protect, as above, the ginseng and other medicinal roots, dated 1873.

Publications on Ginseng.

1714—Philosophical Transactions of the Royal Society of London. Vol. XXVIII, p. 240.

1858—Lafitau, Joseph Francois. Memoir Concernant la Preciuse Plante du Ginseng.

1884—United States Consular Reports. 1884.

1884—Report Dept. of Agr. of U. S. Description of plant with illustration, p. 129.

1888—Druggists' Bulletin, Dec., 1888. Historical and commercial account.

1889—Garden and Forest. Vol. II, p. 47. A hope of possible cultivation.

1890—American Agriculturist, Dec., 1890, p. 645. A. S. Fuller, Cultural Notes.

1891—Bulletin LXV, Exp. Station, Ontario Ag'l College. Guelph, Ontario, Prof. J. H. Panton. Account of history and industry.

1891—Scientific American, Jan. 10, 1891. Nicolas Pike. Note on the industry in native roots.

1891—American Garden, Vol. XII, p. 381, 1891. L. Greenlee, Garden City, N. C. Notes on the industry in native roots.

1892—Bulletin of Miscellaneous Information. Royal Gardens, Kew, No. 64, p. 107.

1892—Garden and Forest, Vol. V, p. 223. Geo. Stanton. Cultural notes.

1892—Report Kentucky Ag'l Exp. Station, p. 19. Prof. Alfred M. Peter. Chemical analysis.

1893—Bulletin of Miscellaneous Information, Royal Gardens, Kew. Nos. 76 and 77, p. 71. Cultural directions.

1893—Garden and Forest, Vol. VI, p. 352. A brief note.

1893—Vick's Illustrated Monthly Magazine, Dec., 1893, p. 23. Geo. Stanton.

1895—Bulletin No. 16, U. S. Dept. Agr., Div. of Botany. G. V. Nash. Commercial History, Protection and Cultivation of American Ginseng.

1896—American Gardening, Vol. XVII, p. 105. Notes by Geo. Stanton.

1896—American Gardening, Vol. XVII, p. 119. C. C. Lindley. Use of fertilizers.

1896—Rural New Yorker, Aug. 29, 1896. A brief note.

1897—United States Consular Reports. Growing demand.

CELERY, ASPARAGUS AND STRAWBERRIES.

By ROBERT M. SIMMERS, *Phoenixville, Penna.*

CELERY CULTURE.

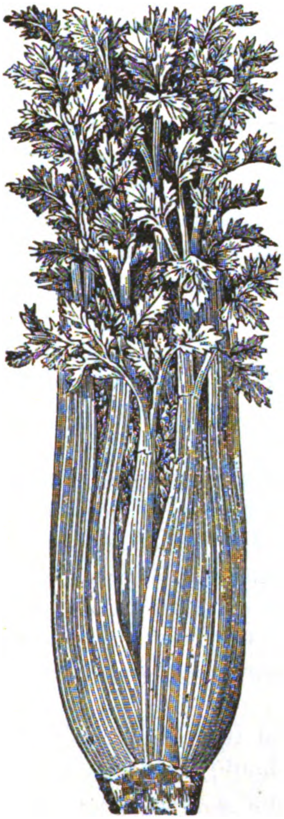
Celery is a vegetable which has become one of the most esteemed and dignified, as it has forced itself into the very highest society. Like many other things, it has become one of the fashions of all the social or political banquets of whatever kind; and one which will be hard to eradicate on account of its popularity and because of the delicious flavor it imparts to the many dishes of the connoisseur. It is also one of the vegetables that fit so admirably in the crop rotation in the home as well as market garden, and is becoming indispensable in both. It affords an opportunity to the amateur as well as the market gardener to raise a profitable crop from the ground during the mid season until winter. It brings a profit to the grower and a daily relish to the consumer during the fall and winter. While competition has greatly reduced the price in recent years, the new varieties that are now being raised, and the later methods and simpler cultivation makes celery quite easy to grow, and also makes it possible to sell at a profit for less than what it actually cost to grow it under the old system.

To raise celery properly and successfully requires considerable judgment and attention on the part of the producer. Even then it cannot be raised at a profit unless its nature is understood and rich soil is used for the purpose. Celery is a rank feeder, and often sends out its little fibrous roots two feet from the stalk; once it becomes stagnant, or its continuous growth is stopped, it becomes hollow and spongy, loses its flavor and gets rusty, to the detriment of its sale and loss to the grower. These misfortunes are sometimes unavoidable, because of the extreme heat, long droughts, or very wet and hot weather.

To grow celery on a large scale every person should grow his own plants, which is easily done if the following instructions are observed. This method has been used by the writer for twenty consecutive years, and has never failed to yield an ample supply of plants. One of the most important things is the purchasing of first class seed from a reliable house.

As early in the Spring as the ground can be worked, a section should

be selected for the purpose and preparation started by a plowing, after which it should be thoroughly harrowed and rolled, and even raked, if necessary, to get it in good condition and free of lumps. The ground should be marked out in nine inch rows, as shallow as possible, and the seed sown thinly without any covering at all, by using a good seed drill. The seed is simply pressed into the earth with a roller



Goldenheart.

New Giant Paschal.

wheel which follows the seed dropper and is attached to the machine; if there is no drill obtainable, and the seed is sown by hand, it can be pressed into the soil by running a light wheel barrow up the rows. After sowing, the patch should be covered lightly with salt or marsh hay, just enough to keep the heavy spring rains from dashing or the sun from baking, and still keeping the moisture in the ground. The hay should be left on the bed until the seed has germinated and the plants are just above the surface; then the mulching should be removed, taking care to do it on a cloudy day, for the plants at this period are very tender, and a hot sun would burn them. Now the bed should be kept thoroughly clean of weeds and cultivated until the

time of planting arrives, which is about June 1st in this latitude for early fall varieties.

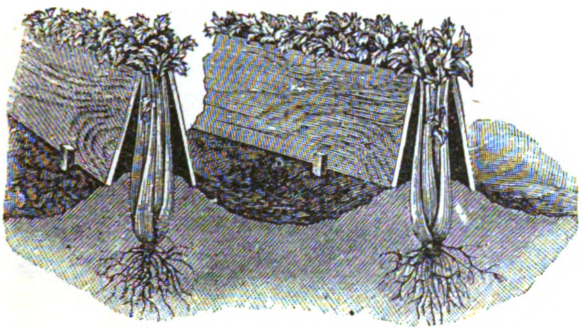
When taking up the plants in the seed bed, care should be exercised to maintain as many of the fibrous roots as possible; and after taking up the plants the end of the tap root should be cut off so as to be readily planted in the rows without being turned up in the hole, which is an injury to the plant. If the plants are large and the tops long, they should be trimmed. The plant by being transferred from its seed bed is somewhat weakened, and trimming will give it a better chance to recover and throw its sap into the heart, consequently lessening the liability to die, especially in unfavorable weather.

In preparing the rows for planting, it is not absolutely necessary to plow the ground immediately before planting, for in the majority of market gardens the ground has been previously occupied by spring crops. It is often necessary to plant the celery between the rows of other vegetables, especially the earlier varieties; but it must be remembered that the soil should be in a high state of cultivation and practically free from stones. Muck or clay loam is better than sand loam on account of its being less liable to rust. In preparing the rows between other vegetables they should be marked out very shallow, as for corn; then the soil should be given a good coat of high grade fertilizer, thoroughly mixed in by running a narrow horse hoe harrow with small teeth up the row, and packed down by drawing a board four feet long and twelve inches wide and having a two-foot chain attached to its end, along the row with the driver standing on it. This will leave a broad flat row in good condition to receive the plants. The reason for this is to prevent the soil from washing into the hearts of the young plants. Nothing will stop the growth of celery or destroy it quicker than dirt covering the heart, and should be avoided at all times.

When the rows are thus prepared, and the conditions of the soil and atmosphere are right, the plants should be planted by a man who understands his business, and using a steel pointed dibbler, which can be purchased at any seed store, for the purpose. The planting can be easily done by kneeling astride the row, using the left hand for inserting the plants in the holes made with the right hand; press the dirt about the plant with the dibbler, taking care not to get the heart below the surface. One man, with a boy to drop plants and other favorable conditions, should plant fifteen thousand plants a day. The later varieties can be planted as late as the first of August, after the spring crops have been removed from the ground, but none of the celery should ever be planted in deep furrows, according to the old English method, for several reasons, two of the most important of which is the flooding of the hearts of the

plants by heavy rains, and the impossibility of the plants getting their nutrition from the soil.

Once the plants are started, all that is necessary is to thoroughly cultivate the crop and give it a chance to send out its fibrous roots into the loose soil, this being necessary for its proper growth. Care should be taken at the same time to keep the hearts entirely free from any dirt. When the cool nights and moist atmosphere of September come, the celery should have a handling. This is done by kneeling on one side of the row, catching the plant with one hand and pressing the dirt around it with the other hand. This treatment is for the purpose of getting the plant in good condition for future use, by keeping the heart free from dirt and giving it a chance to grow. It is very important that the heart be kept clean, for it is the choicest part of the plant. The handling should never be done when the celery is wet, the ground is sticky or in dry weather. In this connection it is well to mention that celery should never be handled when it is wet or has frost on it.



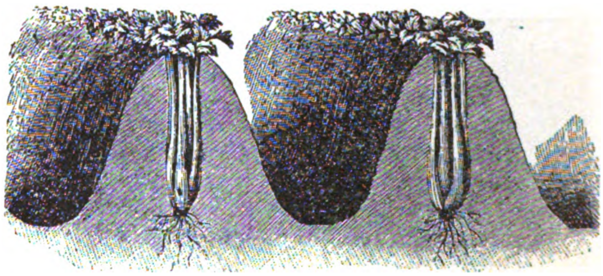
Blanching by Boards.

While there are several improved methods of blanching and preparing celery for market. The one generally used in this vicinity for early fall or self-blanching varieties, is the use of boards. This is done, after the handling previously described, by using a six-inch board on each side of the row. These boards can be of any length, but a sixteen foot is preferable. Lay them down flat on the ground with the edges gently pressed against the celery, then turn on edge and drive three stakes, one in the centre and one at either end of the board to support it. In driving the stakes it is best to cross them at the top to keep the boards up to the celery. In a week or ten days, if it is good growing weather, the young hearts will appear above the edges of the boards, being drawn up by the light. Then the narrow boards should be transferred to the next row and twelve inch boards substituted in the same way. With favorable weather the celery should be ready for market in ten days or less, and can then be taken up and sold.

This method of bleaching is much better than earthing as the plants

are less liable to rust and decay than with the dry, hot soil. Any of the early blanching varieties can be treated in this way with success, but the later varieties being harder to bleach, it is necessary to use other ways, either earthing or by tileing made for that purpose. The advantage of the board method is that you can raise a larger crop on the same ground by planting from two to three feet apart. But when bleaching the larger late varieties, such as the Giant Paschall and the Golden Heart, it is necessary to take out every other row if three or four feet apart and putting it into a trench. The remaining rows can readily be hilled by using a celery hiller. This tool is necessary for a large grower of celery to have and can be obtained in any well equipped seed store.

When trenching celery, ground should be selected that has good drainage, and the trench should be dug as deep as the celery is long and not over ten or twelve inches wide. The celery should be packed in an upright position, making the roots tight, but allowing the tops of the plants to have as much room as possible. A good way is to use four-inch boards, old ones will do, standing them along the top of the



Celery After Earthing Up.

trench and cutting short pieces of wood (barrel staves answer the purpose very well), as long as the trench is wide. Lean the boards against the pieces from each side and press the dirt thrown out of the trench against the outside of the board on each side to keep them in position, and also to prevent the earth from pressing against the top of the celery. After the trench is full it should be wet only once, either by rain or by watering, and kept open until freezing weather comes. An excellent way to keep the water and ordinary cold out is to take sixteen foot boards, twelve inches wide, and nail the two edges together, making a V shaped roof, which can be easily set on the trench. When colder weather comes, the boards can be lifted off and salt hay or straw put on the celery two or three inches thick. In extreme cold weather a layer of horse manure should be placed upon the top of the straw. Then the board roof can be replaced, and the celery kept in this way until after the holidays which is easy to get from the trench when wanted. But it must be remembered that if the self blanching varieties are buried in this way they are not as good keepers as the later kinds, and should therefore be used first.

The winter varieties for late use are buried in banks, making the

bank as high as the celery is long and tramping thoroughly as it is built up. After building one side is cut down straight and the celery is packed three or four stalks thick in a perpendicular position, so that the tops of the celery will come on a level with the center of the bank. When all of the one side of the bank is finished in this way the dirt can be thrown back, with a plow or a shovel, nearly as high as the celery, keeping the stems and leaves in an upright position as the dirt is put up. Be careful not to press the dirt too hard againt the celery at the top, as this will prevent the evaporation of the moisture caused by sweating, and will make the celery decay. This is very important in burying celery in any way, and is frequently the cause of loss to the grower.

Bunch of Celery Ready for Market.

There are five varieties of celery in general use in this latitude. The White Plume, Golden Self Blanching and Henderson's Pink Plume being the early or Fall sorts. The White Plume apparently has the lead of its kind. It is an excellent sort, but it is my opinion that Henderson's Pink Plume is better in quality and flavor. This brand is rather hard to sell, because it is not well known, and therefore not popular, except with lovers of fine vegetables and with connoisseurs. The two late varieties named are both excellent. While the golden heart has become one of the most popular sorts, I believe the Giant Paschall is designed to supersede it. The Giant Paschall is a strong and robust grower; its quality is one of the best, has an excellent flavor and is crisp and a good keeper.

Another important point in growing celery for profit, is in the marketing of the crop. To get the best prices and largest profits it is necessary to make the bunches as attractive as possible, for it matters not how good the quality of the product is, if it is not clean and tied up nicely it is much harder to sell because there is just as much in the looks of an article as there is in the quality. There are a great many ways to put up a bunch of celery to make it look attractive, and the grower should use good judgment and tie his bunches as is best suited for the market he is catering to. Always bear in mind to raise the kind or variety for which there is a demand, and which is best adapted to the soil, and, finally, always try to have a better article than your competitor, otherwise your profits will not be satisfactory, and your labor is for naught.

ASPARAGUS CULTURE.

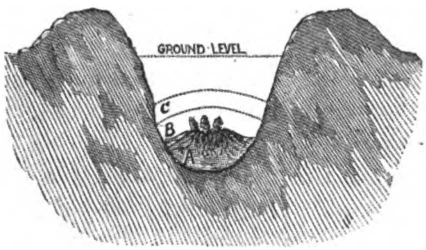
There should be more attention paid to the raising of this delicious vegetable, not only in the market garden but in the home garden as well. It is one of the most wholesome and succulent vegetables, and is also a very profitable crop in either capacity. It comes at a time when the average person's appetite is harp and the system demands this kind of food after a long period of diet on meat, and other winter foods with few vegetables. Asparagus contains many medicinal qualities which eminent physicians have pronounced of great importance in certain diseases contracted during our limited diet of the winter months.

From a business standpoint, it is also an excellent crop. There are few crops that will give better returns if the plants are properly started and taken care of. At the same time it should be borne in mind that asparagus is a strong feeder, and like other plants of its nature, being a fast grower, requires a vast amount of plant food and fertilizers. A market gardener who raises this vegetable for sale, and has a demand for the same, can readily clear a net profit of from two to four hundred dollars per acre, according to the locality and the competition he may have in the same business. An asparagus bed, properly planted in the right kind of soil, and properly cared for, will last at least twenty years without any replanting, and the owner of such a patch will be certain of a good income from the crop every year. To make asparagus growing a success it is necessary to have the right kind of soil, having either south or southeast exposure and good drainage. These conditions have considerable to do with the earliness of the crop and consequently affect prices. The soil best adapted for the purpose is a sandy loam in a high state of cultivation.

As five years are required from the time of sowing the seed until the asparagus is ready for marketing, there is a tendency for many growers to hesitate and become discouraged in planting this vegeta-

ble. This is one of the reasons why there is not at this time, or will not be in the futre, an over-production of this excellent plant. But two years may be saved to the grower by the purchase of two year old plants and starting a bed that much time ahead of sowing the seed. These plants can be procured from any reliable seedsman for five to eight dollars a thousand, true to name. This method is much cheaper and more satisfactory than sowing the seed and risking the possibility of failure after two year's labor. It is well to remark here that the price of your crop depends entirely upon its quality, succulency and earliness, which in return depend upon the nature of your soil, proper manuring and care, and marketing, also, at the proper time.

After selecting the ground which is best adapted for the cultivation of asparagus, the soil should be prepared by thoroughly plowing, harrowing and rolling. Then the ground should be marked out, for market purposes, by plowing furrows five feet apart; going up and down the rows twice with the plow, throwing the dirt out on both



Planting Asparagus in Furrow.

sides of the furrow and making it from ten to twelve inches deep. Following this preparation, two or three inches of rich, well rotted compost or manure should be put in and covered with about the same depth of soil. It is best to take a horse hoe harrow with long teeth and set narrow making it about fifteen inches wide, going up and down each row twice, thoroughly mixing the soil and compost together, and at the same time making the bottom of the furrow near the level by dragging small portions of the soil from the sides of the furrow with the teeth of the harrow.

The soil should be prepared as described previous to the purchase of the plants, so that the same can be transferred to the ground immediately upon their arrival from the seedsman. Planting should occur in this latitude as early in the spring as the ground can be worked and all danger from hard freezing is past. In setting out the roots it is necessary that the fibrous roots should be spread out in their natural position as near as possible; place them about two feet apart in the rows and at such a depth that the crowns will be from six to seven inches below the level, and the dirt properly pressed against the roots. The covering at first should not be more than two inches

in depth, then there should be another coating of good rich compost placed on top of that, taking care that the bottom of the furrow at the level of the crown should be wide enough to keep the furrow from washing shut and destroying the young shoots by heavy dashes of rain.

After the young plants begin to grow it is necessary to keep out all weeds by hoeing the rows between the plants and cultivating the sides of the furrows with a fine toothed hoe-harrow, gradually filling up the furrows as the plants grow, but at the same time not allowing too much dirt to get into the furrow until late in the fall, when the plant will be strong enough to take care of itself. A bed planted in this way, with proper care and with plenty of rich manure worked into the soil every spring either by plowng, or which is better, by running a spring tooth harrow over and thoroughly mixing to a good depth, will last a number of years, and will insure good returns for the labor and patience required of the owner. When the bed is once planted, it should be well cultivated and manured every year. But it should be remembered that none of the asparagus should be cut until the third year after planting, and the wise grower is he who cuts sparingly even at that season, as the plant is not at its maturity and will not stand hard cropping until the fourth year, when there is no danger of injury to the plant.

The cutting can begin as soon as the young shoots reach five or six inches above the ground. They should be cut every morning regularly during the season, which lasts in this season until the first or tenth of June, after which the crop should be given a chance to recuperate and get itself in condition for the following year. Always bear in mind the necessity of keeping the beds free from weeds and grasses, which are a positive injury to asparagus, and if left alone would eventually destroy the bed. Salt is an excellent article to spread on the beds after the spring cultivation and about the time the weed seeds begin to germinate; it will kill the majority of weeds and will not affect the asparagus, owing to the nature of the latter plant. Nitrate of soda, applied at the rate of about two hundred pounds to the acre, in the spring of the year, and about the time the crop is shooting through, is an excellent stimulant and its use will prove a good investment.

When cutting the stalks, a sharp pointed knife should be used, and the stalks severed about one inch under the ground, care being exercised so that none of the young shoots just coming through the ground are cut or broken, as an injury to the bud will cause the loss of the stalk. Asparagus should never be allowed to get old or left stand until the crown buds commence to shoot from the stalk, as it then loses its flavor and tenderness and such should not be taken to market, or it will hurt your reputation for growing a good article. For market-

ing, the stalks should be tied into nicely shaped bunches, four or five inches in diameter, as the market demands. Keep the bunches firm and tight by tying with a good, stout, soft string, rejecting all ill-shaped and undersized stalks, and cutting the butts to an even length after tying, thus, making a neat and saleable package.

To obtain the best prices for asparagus, it should be taken to market immediately to enable its being sold as soon as possible after cutting and while it is in a fresh condition. No matter how tender it may be when bunched, if it is allowed to stand around in the different stores and market places and become stale, it will be more or less tough and lose its delicious flavor, and consequently cause a loss to the grower and to the retailer.

Conover's Colossal and the Philadelphia Mammoth are the two brands of asparagus generally grown. Both are of excellent flavor, and are rapid growers. To raise the Philadelphia Mammoth it should be planted at least three feet in the rows instead of two, as required for Conover's Colossal.

STRAWBERRY CULTURE.

No work on vegetable and market gardening could justly be called complete if it failed to take notice of the strawberry and its culture. Because it is the most luscious, most desirable, and the queen of all fruits; not only in the home garden, but the market garden as well; coveted by both the young and old consumer. A most enjoyable luxury and a potent medicine at the same time, and it also fits admirably in the crop rotation of the market garden.

The market gardener who retails his own product to local or near by customers, finds it a useful crop, and one which adds many dollars to his receipts during a period of two or three weeks annually, without requiring very much extra time to dispose of it. During the strawberry season, we generally find the market abundantly supplied and frequently overstocked with this fruit, such as it is. Poor, coated with dust, jammed, ill-looking, and anything but inviting to people who are used to getting them fresh from the garden. It averages poor, and so equally and deservedly does the price which the grower realizes from them. On the other hand, real first class fruit, large, even, fresh, packed neatly in attractive boxes, is rare and always in demand at paying prices.

The premium is on superiority. There is scarcely any overproduction of good berries. Large, well colored, perfect berries, have always been in demand, bringing good prices, and prove profitable to the producer, as well as the dealer.

Like the onion among vegetables, so is the strawberry among fruits. A great money crop for the skillful producer, but a source of annoyance, disappointment, and even loss to the shiftless manager.

The chief aim of the grower should be to raise fine berries, pick them at the proper time, and take them to market in the best possible shape. Have them uniform in size and deliver them to the customers as soon after picking as possible.

The best soil for growing strawberries, in my opinion, is well drained clay loam. But a good crop can be grown on any soil that will produce good corn. The nature and lay of the soil generally have considerable to do with the season of ripening. A sandy composition of soil, with a southeastern exposure, will bring an early crop of berries, while a muck or clay soil, having a northwestern exposure, with mulch left on until late in the spring, will bring much later crops; and the grower, who has the selection of such conditions, can generally lengthen his berry season, and consequently get more money from his crops.

In planting strawberries, old sod should be avoided, as it is usually infested with white grub and other insect enemies. The best ground for planting strawberries is soil which has been highly manured, thoroughly cultivated, reasonably free from weeds, and previously worked for one or two years with other vegetable crops or corn.

The best strawberries can only be grown on fertile soil. Too much manure cannot well be applied, although it is not necessary to give the soil an overdose. Well decomposed stable manure is a reliable fertilizer, and if free from weed seea, and enough of it, there will be no reason to look for anything else. But we should never use any manure that is liable to befoul the land with weeds, as the latter are a curse to the strawberry bed, and an annoyance to the grower. If the strawberry bed once becomes a bed of weeds, the sooner it is plowed down and a new bed planted, the better it will be for the berries, and less will be the loss to the producer.

On ordinary good soil, good crops of berries can be raised with concentrated commercial fertilizers, and they have the advantage of being free from weed seed, thus lessening the danger from fungus diseases and making really a better berry than the stable manure alone. Muriate of potash and bone meal applied liberally are a special benefit to the strawberry bed.

The roots of strawberries usually go down deeply into the ground without spreading a great deal; hence the soil should be loosened up to a considerable depth. If we use stable manure it should be plowed in. But on the other hand, if we use concentrated fertilizers, they should be put on the surface after plowing and thoroughly worked into the soil with a spring-tooth harrow, or other instrument that answers the same purpose.

I have found that planting strawberries in solid beds and planting every year, is the most economical and produces the best results. In this latitude strawberries should be planted in the spring, as soon as

the frost gets out of the ground, and it can be worked into the proper condition, and when the plants commence to show sings of new growth by pushing out new leaves.

After the ground is in proper condition, mark out the rows one foot apart and plant every fourth row, putting your plants, if strong runners, in single rows one foot apart. If plants, which do not produce so many runners are used, they should be planted in double rows about nine inches apart in octagonal shape. If the plants are staminate, or perfect flowering plants, they can be planted with the same variety in consecutive rows. But if the plants are of the imperfect or pistillate varieties, every third row at least should be planted with a staminate variety, and one which is known to be a free bloomer. If this is not done, you will have a poor crop and imperfect berries. It has been found that by planting the different varieties in this proportion, it will greatly increase the crop and also the quality of the fruit.

When berries are planted in the spring of the year, they should, under no circumstances, be allowed to fruit the first season. All such

Perfect Strawberry Blossom.

Pistillate Blossom.

fruits should be picked off and the soil kept clean from weeds, if you wish to obtain good strong plants and a good crop the following season. In this connection it also should be remembered that strong, vigorous plants—young runners from the previous year—should always be used. These can easily be known by their fibrous roots, the roots of the old stools being very dark or nearly black, and the roots of the young ones a light yellowish color.

It is always best, when planting out a bed of strawberries, to have good, strong, fresh, vigorous plants, because we cannot raise a good healthy crop of berries from a poor crop of plants, any more than we can raise a good crop of vegetables from a poor or inferior quality of seed. In planting a strawberry bed in the way suggested in this article, the grower can raise, during the first season, an excellent crop of different varieties of vegetables in the intervening rows, and there is therefore no loss of ground. At the same time keeping the ground free from weeds while you are cultivating the vegetables.

The best results can be obtained in strawberry culture by planting a new bed every year and plowing the old bed down immediately after the first crop. But never plant a new crop of berries on an old bed.

It is also better, if the grower has no suitable plants of his own, to get them near at home, from reliable growers, so they can be freshly dug and not withered or dried.

In planting the plants it is necessary to get the roots in their natural position as near as possible, with the crown at about the level of the surface, and the soil firmly pressed around them. The dirt should never be soggy, neither should it be dry, but just contain enough moisture to make it crumbly or pliable.

After the plants are started, the soil should be kept perfectly clean from weeds, and the new runners trained into the proper shape to form a new bed for the crop in the coming season.

As to the kind of berries, they should be of the best, and the variety should be that which has the best flavor, the finest appearance, and the largest size; and that which will best please the palate of the local consumer wherever they are raised. For fruit is like vegetables. You must cultivate the taste of your customer and be in the fashion; for fashion nowadays controls the world, not only in dress and society, but also in the vegetable creation. And if we are not in the fashion, we are not in it.

Different varieties of berries are suited to different varieties of soil, and I therefore will not dwell further upon this subject, but as to what variety is best suited to one's particular trade, I will leave to the judgment of the producer or grower himself.

Strawberry plants are quite hardy, but at the same time they are liable to destruction, to a considerable extent, by being raised from the ground during the different freezes and thaws of winter. They, therefore, should be given a winter coat or mulching, not for the purpose of excluding the cold alone, but also to prevent the frequent thaws which are most always recurring during this time, and especially toward spring. For it is not the freezing which injures the plants, but as stated before, the changes of temperature which causes the damage to the fruit buds and roots and, if not properly protected, it will be unavoidable.

There is nothing better for this purpose than salt or marsh hay, because it is perfectly clean of weeds and has a natural tendency to work itself down close to the ground and between the plants. Also because of its less liability to decay; it can be left on the plants during the summer, keeping nice and moist, while at the same time keeping the fruit perfectly clean.

This hay is to be obtained quite cheaply, costing from six to nine dollars per ton in bales at any large hay or feed store.

Mulching is absolutely necessary on ground where the soil has the tendency of upheaval by the action of the frost.

In conclusion will say that no grower can be successful unless he produces the best varieties which apparently are in the most demand at his particular place. Always give good measure, uniform ber-

DONEGAL EXPERIMENTAL STATION, 1897.

ries and let your customers know that your berries are just as they are represented, both as to quality and kind. When you have the confidence of your customers, you have gained an advantage over your competitor which cannot be easily taken from you.

TOBACCO GROWING IN PENNSYLVANIA IN 1897.

By F. R. DIFFENDERFFER, *Lancaster, Pennsylvania.*

No reports on the tobacco crop in this State having appeared in the annual volume of the Department of Agriculture for a number of years, and as this industry has steadily held its own during the past twenty seasons along with other staple crops of the Commonwealth, it has been deemed expedient to present a view of the progress and present condition of tobacco farming as it exists among us at the present time.

As a general thing it may be said, that, save in one or two particulars, no radical changes have taken place in the methods of planting, cultivating, harvesting and curing the crop. But while the old time lines and methods still prevail to a large extent, a number of minor changes have been brought about, some the result of necessity, and others such as the practical experience of the tobacco growers themselves have shown to be necessary and expedient. I shall allude to such of these as seem deserving of mention, and also endeavor to present as briefly and clearly as possible, such new features as seem to commend themselves to farmers who are anxious to keep abreast of the most advanced ideas of their calling.

EIGHTEEN YEARS AGO.

When the last extended report on the culture of tobacco in this State was written eighteen years ago, the crop had reached high water mark, so far as quantity was concerned, and it was thought at that time that the limit had been reached. The estimate for the season of 1879 was 60,000 cases, with a possibility that it might go even beyond those figures. Since then the product of the State has fluctuated from causes that will be stated later on, but during several seasons it reached the great total of 80,000 cases. The same prejudices that then prevailed among some persons to growing tobacco on moral grounds, have not died out, but the value of the crop as a money producer, its profitableness, its generally ready sale, the small outlay of ready money required to grow it and the large returns swept away the ob-

jections of many and the area has been gradually extending until the product reached the dimensions already stated.

OUR SUPREMACY CHALLENGED.

When Pennsylvania first ran her crop up to 80,000 cases, one-half of which, and sometimes more, was cultivated by the single county of Lancaster, she stood far above any of the other cigar leaf tobacco growing states. No other even approached her in this particular. But a rival has come upon the field. While the New England states have not exceeded their product of fifteen or twenty years ago, and while the same may be said of New York, a most formidable rival has, like young Lochinvar, came out of the West, and to-day the State of Wisconsin with her product of from 60,000 to 100,000 cases has challenged our supremacy, not only in the matter of quantity, but also in a measure in the quality of her product. It is true, her tobaccos do not rate as high in the markets as our own, but they form excellent binders for cigars, and their cheapness besides, makes them a most serious rival of Pennsylvania grown goods.

But it is not in Wisconsin alone that our State has encountered dangerous rivalry. Fashion has stepped in and declared that the rich brown shade which marks the best Pennsylvania leaf, is not in accordance with the highest taste, and proclaimed that the cinnaman colored article grown in the valley of the Connecticut is the correct thing, and the result has been that our growers can no longer command the prices they formerly did, but have been compelled to occupy a second place, with a loss of prestige and a reduction in the market value of their product.

THREE SUCCESSIVE BAD SEASONS.

Still another and a more serious drawback has come to our growers. For three successive seasons the weather conditions were unfavorable. It is well known, that for its best and highest development, the tobacco plant requires a reasonable amount of moisture all through the growing season, especially during the twenty or thirty days prior to harvesting. Unless it gets this, the plant comes to a standstill, and the leaves grow thick and leathery. That was the case in 1894, 1895 and 1896. The crops in these years were undesirable, and not such as manufacturers wanted. The result was that the packers lost much money on some of them and were unwilling or unable to pay remunerative prices. All this was further accentuated by the improper treatment of the tobacco in the stripping rooms by many growers, who used water too freely to increase the weight of the crop. The result was that many crops developed black rot after they were cased and had undergone their sweat, entailing heavy losses on the holders. White vein also came along and added to the trouble. The result was that Pennsylvania tobacco growers got a "black eye," in the language of the

trade, and prices went down to the lowest figures known. In fact, it became difficult to sell these goods at much above the cost of production, and the result was that the acreage gradually dwindled until in 1886 it reached the lowest point known in twenty years, 8,500 or 9,000 acres, just about one-half the acreage of our best year.

During the growing season of 1897 the condition of the previous four seasons was completely reversed. There was plenty of rain at planting time and except one unimportant short interval, this was kept up almost until harvest time. The plants kept growing without pause or drawback, and the result has been one of the leafiest crops ever grown in the State. Although the acreage was not more than 25 per cent greater than in 1896, it is almost certain that double the quantity of tobacco has been grown. A heavy growth is generally accompanied by superior excellence in the leaf, and this condition promised to be realized in the crop of 1897.

MANUFACTURERS NEED OUR FILLERS.

While the foregoing clearly demonstrates that successive seasons of poor crops and consequent poor prices may greatly affect the extent of the crop, there are abundant reasons for asserting that tobacco will continue to be one of the staple agricultural crops of Pennsylvania. In the first place, even though our wrappers are no longer in the demand they were twenty years ago, for reasons that will be given later on, our fillers are still among the best grown anywhere in the world, not even excepting the choicest products of Cuba, and will for that reason always be held in high esteem by manufacturers. This fact is most clearly demonstrated at the present writing. The war in Cuba has interfered very seriously with the tobacco production of that island, having cut it down more than one-half. The authorities of Cuba have in consequence prohibited the export of these goods in order to keep their own factories running. The result has been that while an entire year's supply was brought into the United States before the Spanish export prohibition went into operation, the price in our markets has increased one hundred per cent. and the supply is being rapidly exhausted. This fact has driven the manufacturers of high grade cigars to the extensive use of the excellent filler tobacco grown in Pennsylvania, and it is a well known fact that the "pure Havana filler" cigars now put on the market are by no means such. but that into nearly all of them a large proportion of our domestic filler tobacco is put, while into still others, no Havanna fillers enter at all, the whole being our home grown product. Whatever may be said about the morality of this deception, the fact remains that so nearly does our best Pennsylvania filler tobacco approach that of Cuba in quality and flavor, that smokers are unable to detect the difference.

THE SUMATRA TROUBLE.

The most serious injury the tobacco growing industry in Pennsylvania, and indeed, all the other cigar tobacco growing States, has encountered, has come from beyond the sea. In 1880 and 1881 there was a scarcity of fine wrappers in the crops of all the leaf growing States. The result was that manufacturers were constrained to look around to see where the needed article could be found. It was found that a highly desirable wrapper leaf was grown on the island of Sumatra, one of the possessions of Holland, in the East Indies. This Sumatran tobacco differs as greatly from our splendid leaf tobaccos as two types of tobacco well can. It is a tall plant with as many as twenty leaves of small size, thin, glossy, soft and silky, and so finely veined that the entire leaf can be utilized for wrapper purposes. There is absolutely no waste to it, so to speak, and as a covering for high grade cigars it has no equal. Two pounds of it furnish enough wrappers to cover a thousand cigars, whereas at least ten pounds or more of our best seed leaf were required to do the same. It is true, the Sumatran leaf has a bitter flavor, and is undesirable for that reason, but the quantity in a thin wrapper is so very small, that this quality is imperceptible when placed around a cigar.

In short, the wrapping qualities of that tobacco have proved so attractive to cigar manufacturers, that despite its original cost and the still higher custom duties placed on it, the importations of it into the United States have increased from 179,602 pounds in 1881, to 196,931 bales for the year ending June 30, 1897. It will readily be seen how seriously this foreign interloper has injured the home tobacco growing industry. It displaced Pennsylvania wrappers to the extent of many millions of pounds annually, and it was on their wrapper grades that our farmers made their money. The growers of the country united in self defense and succeeded in having a duty of seventy-five cents per pound laid on imported wrapper tobaccos. Even that put no apparent check on the importations, and it was increased to two dollars per pound. It still continued to come in however. The duty was then lowered to a dollar and fifty cents, which gave importations a fresh impulse. The Dingley tariff bill in July, 1897, again increased the duty to one dollar and seventy-five cents, which is the rate at this time. Such a hold has the Sumatran fad taken of smokers, that all high class cigars are now covered with it or Cuban leaf, and it has been put on cigars that sell in the market as low as $14.

The business depression of the past few years has, strange to say, brought some relief to our tobacco growers. Smokers no longer indulged in so many high priced cigars, but contented themselves with a cheaper article. To meet this new condition of things the cheaper domestic grown wrappers were again put on cigars to a far greater degree, and this is the case up to the present time.

Within the past two or three years, and also owing to the pressure of the times, a cheap cigar known as the "stogie" has been put upon the market. In appearance it is long and slender and not sightly. Filler and wrapper are of domestic tobacco. The quality is quite equal to that of the other low priced cigars on the market, but cheaper labor is employed in its manufacture, and it can be sold at a less price. Men who care more for a cheap, good smoke than mere appearances, have taken it up and it is rapidly gaining in favor. Large factories for its manufacture have been erected and vast quantities are now on the market. At first dealers did not care to handle them, but the increasing demand from smokers compelled them to change their views, and the "stogie" is now found in nearly all cigar stores. Of course, smokers who are able to pay the prices asked for highgrade goods will continue to buy a straight-out Havana article (with its Pennsylvania filler), but the person of more moderate means will compromise on the cigar which from first to last, both in its material and workmanship is purely an American product. The "stogie" industry will no doubt in a few years create an increased demand for home grown wrappers.

THE CULTIVATION OF THE CROP.

While it has been said that on the whole the cultivation of tobacco has not undergone any notable changes from season to season during the past ten or fifteen years, yet when we review that period as a whole we find these changes have been neither few nor unimportant. Twenty years ago too many farmers believed in their self sufficiency that they knew it all. They were getting wonderful prices for their products, were getting rich by it, and did not worry about new and improved methods, or give their time to experimentation. Out of this blissful dream of security they were roused by the Sumatran invasion, and in recent years they have been driven by the law of self preservation to give that increased care and attention to the crop and all relating to it, which its importance as a money maker and a mortgage lifter demands.

The result has been that during the past five years especially, very important advances in the methods of growing the crop have been made. Of the more important of these we shall proceed to speak.

THE TOBACCO GROUND.

Twenty years ago, the opinion was almost universal among Pennsylvania tobacco farmers, that the same ground should not be planted to tobacco more than two or three seasons in succession. The tobacco plant was known to be a voracious feeder, and the crop consequently an exhaustive one. It was therefore not desirable to exhaust the soil by continuously planting this crop on the same spot. But there was another patent reason for this practice. As the tobacco field was always very heavily manured, much more so in fact than any other portion of the farm, it was felt that it got an undue share of the

home made fertilizer, and that the remaining acres were made to suffer in consequence. That was not prudent farming in the eyes of our conservative tillers of the soil, and they accordingly got around the difficulty by putting the tobacco patch on a new place on the farm every year, and in this way every field got its share of the heavy manuring given to the tobacco patch. To-day the advanced tobacco grower makes no note of this old time custom. He has learned something. Hundreds of experiments have taught him that he can ignore that old time idea. Tobacco is now grown on the same ground year after year without either deterioration of the product, impoverishing the soil or doing an injustice to the rest of the farm. There are many cases where tobacco has been grown from five to fifteen years consecutively on the same spot, with a crop as fine in quality and as large in quality the last time as the first one set out, and the land even in better condition than in the beginning. There are few farms that have not one or more places on them, where this crop does better than on the rest. The rule now is, especially in Lancaster county, to ascertain these choice localities, and plant the tobacco crop on them from year to year. The advanced tobacco farmer will do this every year, and we believe the longer he continues the practice, using the precautions necessary to keep up the fertility, the more satisfactory will be the result. The writer advocated a change of locality from year to year, or every few years, in these pages many years ago. He has had abundant reasons for changing his views since then, new experiments and new methods having fully demonstrated the wisdom of the change.

A CHANGE OF BASE EFFECTED.

The large imports of Sumatran wrappers brought about a very remarkable change in the domestic tobacco crop. Not only in Pennsylvania, but throughout New England and the state of New York.

Almost the only variety cultivated twenty years ago was broad leaf, or seed leaf, as it was usually called. This is a large, strong variety, with long, broad leaves, and excellent in quality for fillers, but objectionable as a wrapper tobacco, because of its heaviness. But it was the type usually grown in the State at that time. When it was seen that a finer, thinner, silkier and glossier article was required in order to better combat the Sumatran wrapper leaf, growers began casting about for a substitute.

Havana seed, or a tobacco grown from pure Cuban seed the second or third year after its domestication here, was believed to be the best rival available. The local newspapers, and especially those which gave the question of tobacco culture special attention, began to urge the substitution of this variety for the broad leaf, then in general cultivation. The farmers recognized the gravity of the situation and quickly fell in with the suggestion. The result was that during the three succeeding years the Havana seed became the popular variety, to the almost total exclusion of seed leaf. Such a sudden change from

a favorite leaf to one which had previously met with no favor whatever, was a very remarkable occurrence. The yield of Havana seed was much less to the acre because of its smaller and thinner leaves, but as it for a time, commanded very high prices, the loss in weight was in part at least made up.

But even this substitution of a new variety, which at first looked so promising, and which when at its best made a wrapper so excellent that it was difficult to tell it from the Sumatran one, was unable to make permanent headway against the foreign invader, and that is the situation to-day. Even the high duty of $2 per pound which was imposed by the tariff of 1890, was unable to check to any considerable extent the importations of this wrapper leaf. The importations during the last ten years have averaged about 4,775,000 pounds yearly. Owing to its extraordinary wrapping qualities, that amount of leaf is sufficient to cover fully 2,000,000,000 cigars, which is equivalent to about one-half the entire cigar production of the United States. From this it may be seen how seriously the importations of Sumatran tobacco have injured this industry in the United States; it has in fact made the growing of the crop almost unprofitable in some years. A reduction of the duty in 1894 to $1.50 per pound again augmented the evil. During the present year the duty was again changed, this time to $1.85, at which it now remains.

EXTENT AND VALUE OF THE SUMATRAN.

As a matter of interest a few statistics concerning the extent and value of the Sumatran tobacco crop may be given here. The following table will serve to show the rapid increase in the production of this crop during the past thirty years:

Year.	Bales.	Value.
1864,	50	$1,600
1866,	174	12,000
1868,	890	80,000
1870,	3,114	200,000
1872,	6,400	400,000
1874,	12,895	1,150,000
1876,	29,000	2,500,000
1878,	48,000	3,650,000
1880,	65,000	4,500,000
1882,	102,000	8,500,000
1884,	125,000	11,000,000
1886,	139,000	13,000,000
1888,	82,000	14,000,000
1890,	234,000	10,000,000
1892,	144,000	11,000,000
1894,	192,000	14,000,000
1896,	190,931	12,860,000

The prices of these goods have been held up to a remarkable extent. The lowest average price was in 1864, when it averaged 17 2-5 cents; the highest average was in 1873, when it went up to 66 cents. The 1896 crop of 190,931 bales, about 34,000,000 pounds, sold at an average of 40 2-5 cents.

THE OLD AND THE NEW IN FERTILIZERS.

In no one thing has a greater change taken place in tobacco growing, than in the views held concerning fertilizers fifteen years ago, and those held to-day. At the former period, barnyard manures were almost the only fertilizers employed in this State by tobacco growers. It was hardly thought possible to grow an acceptable crop without it. The tobacco packers were in a large degree responsible for this. They had a theory that the adhesive white ash so desirable on cigars was largely due to the use of home made fertilizer. They were accustomed to go into the country and note what farmers used artificial fertilizers, and those using stable manures. The preference was always given to tobacco grown by the use of the latter, while the former was always discriminated against; either a smaller price was offered for it, or it was rejected altogether.

Since then the tobacco trade has changed front on this question. The stable manure, while still largely used by most tobacco growers, is no longer in the favor it once was, either by the tobacco growers or the tobacco buyers. The latter have found out that the character of the soil largely governs the character of the ash, as well as the quality and texture of the leaf. They have also learned that a finer quality of leaf is now demanded by manufacturers and that this cannot be produced by the exclusive use of stable manure, hence they have turned away from it and given their preference to other fertilizers.

On the other hand, the establishment of the Experimental Tobacco Stations have also been a revelation to farmers themselves. They have seen with their own eyes series of experiments tried year after year which have swept away some of the theories formerly held. Every year the plats fertilized with stable manures have proved far inferior to those that were treated with artificial fertilizers. The difference between the tobacco fertilized by these two manures is against that which has been treated by the home made article to such an extent that argument is out of the question. Where a dozen kinds of fertilizers are tried side by side, the plats treated with stable manure are invariably among the poorest of them all. If it were not that commercial fertilizers make considerable drains on the tobacco grower's profits, they would be more used than they are. Then again the tobacco crop is planted and harvested within a period of about three months. It is very clear therefore that whatever the manurial application, it should be in a condition so that the plants can at once avail

DONEGAL EXPERIMENTAL STATION, 1896.

themselves of its virtues. Barnyard manure, as all know, does not come up to this requirement. Decomposition must take place before it can give crops the assistance expected of it. In the case of tobacco, it is more likely to benefit the crop which comes after the tobacco, than the tobacco itself. These several facts are so clearly established as to be beyond contradiction, and to-day the more advanced growers give more attention to commercially prepared fertilizers than to the product of their own stables.

EXPERIMENTAL STATIONS AND THEIR WORK.

Allusion having been made in the preceding paragraph to the experimental stations now established by the State, fuller mention of them and their work will be appropriate here. The first appropriation for this purpose was made by the State Legislature in 1892, and experimental stations were established during the same year at Rocky Springs and at Donegal, both in Lancaster county. The Lancaster County Tobacco Growers' Association was instrumental in securing this appropriation. Appropriations were made by succeeding Legislatures until two years ago, when they were discontinued, owing to the reduced condition of the State finances. In order to continue the good work, and to give the tobacco growers the benefit of further experimentation, the present efficient and honored head of the Department of Agriculture has, out of the too limited appropriation made to his own department, advanced the necessary funds to carry on the work of the Experimental Stations at Donegal and at Bradford during the past two seasons.

EXPERIMENTS WITH FERTILIZERS AT THE EXPERIMENTAL STATIONS.

The practice from the beginning has been to divide the ground into twenty different plats, of equal size, numbering them consecutively from one to twenty. On two plats the same fertilizer is tried, but the plats themselves are not contigious, other plats lying between them, so that should there be any difference in the soil, or any other differences, they may be made apparent. Dr. William Frear, of the State College, has prepared all the artificial fertilizers for these plats from the beginning, and the several formulas, as well as outside fertilizers that are tried, are all carefully marked on head boards affixed to each plat.

It is not necessary to give the results of these experiments in detail. A few general results may however be mentioned. The plats that were treated with hard wood ashes have shown up very poorly for several years in succession, both in dry and wet seasons, thus exploding the theory that ashes were a superior fertilizer for this crop. Stable manure has been equally disappointing when used by itself. Almost every fertilizer that has been tried, has done better than wood ashes and stable manure.

One of the various formulas prepared by Dr. Frear, and tried every year, is the following:

	Pounds.
Dissolved bone black,	880
Carbonate of potash and magnesia,	715
Cotton seed meal,	1,300

The quantities given are the rate applied per acre. In five successive seasons this compound has demonstrated its excellence. Unfortunately this fertilizer is not on the market, but has been prepared for these experiments only, in the laboratory.

The other fertilizer which gave the best results was supplied by a Chicago firm. The results that followed its use were highly satisfactory, and the tobacco on the plat is among the best on the entire field. It is known as Tobacco Formula No. 2, and its composition as set forth on the packages is as follows:

Nitrogen,	4.11	per cent.
Ammonia,	5	"
Total phosphoric acid,	10	"
Equal bone phosphate,	21	"
Available phosphoric acid,	8	"
Water, soluble,	6	"
Potash, actual,	10	"
Potash sulphate,	18½	"

In this tobacco fertilizer the tobacco grower has a mature, ready made, which has shown itself eminently adapted to his needs, and which, unlike the first mentioned, is easily procurable.

On all the plats on the farm, Havana seed was the variety planted, and all the plats were planted on the same day and in the same way. It is not too much to say that the small amount of money these experiment stations have cost, has been amply paid back in the interesting and valuable information they have brought out year after year. Wide awake tobacco growers have learned much from them.

TOBACCO BARNS.

Less change has taken place in the construction of tobacco barns than anywhere else along the entire line of tobacco growing. The old type of curing shed is too well known to require description here. All new barns are constructed with horizontal side openings instead of vertical ones, the doors operated by a series of levers. The opinion has been advanced by some of the most skilful growers that a single horizontal opening one or two feet wide, at the floor, and a corresponding slatted opening at the comb of the roof, would be best of all.

The "Snow process" of curing tobacco has been tried at the Donegal

Station. This requires a close barn. The leaves are striped from the stalk as they ripen, the lower ones of course, first; they are taken to the barn in baskets and hung on wires attached to the usual laths. In this way much more tobacco can be put in a barn, than when the entire plant is hung up. The curing is then done by artificial heat. This prevents mould, and other casualties and the entire process is easily controlled. As this process requires a costly barn, and its superiority is not fully demonstrated, it has not been introduced in this State to any extent.

THE TRANSPLANTING MACHINE.

While tobacco planters have been very generally introduced in other States, Pennsylvania held off until a few years ago, and even now more than half the crop, perhaps three-fourths, it still planted by hand. This is no doubt owing to two reasons; first, because the machines cost a good deal of money, and secondly because the acreage of tobacco by the majority of Pennsylvania tobacco growers is too small to warrant the purchase of a planter by any except large growers. But this difficulty is now overcome either by a number of growers purchasing one jointly, or by the purchase by some one man who then plants tobacco for his neighbors. There is no question about the superiority of machine planting over hand planting. The plants can be set evenly at any desirable distance apart. The planter can carry a supply of water when the season is dry, so that plants can be set out whenever they are ready, no matter whether the ground is in proper condition or not. A fertilizer attachment can also be used, which is an additional advantage. By this machine, planting a single row at a time, from three to six acres can be planted in a day. Machine planted tobacco gets a quicker start than hand planted, and few sound plants fail to grow. The better the ground is prepared, the better the work done by the machine. It seems likely that in a few years most of our tobacco will be planted in this way.

CUTTING TOBACCO IN THE FIELD.

Years ago the men who went into the tobacco field to cut down the plants, were provided either with a light hatchet, a corn cutter or even a small saw. The stalk was bent over, and the implement applied close to the ground. It was a slow as well as an unhandy process, and has been greatly improved upon. At present a pair of steel bladed shears, with sockets attached at a certain angle, into which wooden handles are fixed, is the article principally used. The operator walks along the row, applies the stout blades of his shears to the stalk, and aided by the leverage in the long handles, easily and quickly cuts down the plants without even touching them and deftly causes them to fall away from the row. It is a great improvement on the old method.

INDIVIDUAL EXPERIMENTATION.

But while the State has come to the assistance of the tobacco growers through the medium of the Experimental Stations, the farmers have not been idle themselves, but have during the last two or three years especially, been experimenting on their own account, with the view of improving their product. They have come to recognize that tobacco comes first among all agricultural crops in its demands for careful, continuous and scientific culture. They have also through dear experience learned that a far higher grade of tobacco is now demanded by manufacturers than was the case twenty years ago, and that to meet these requirements new methods must be employed. They have learned that the low prices at which tobacco has been selling for some years past place a limit to the cost of the fertilizers used, and that some method of counteracting this expense must be employed.

Advanced growers have adopted the practice of seeding their tobacco fields to rye in the fall. It is now recognized that land should not be allowed to lie bare and exposed through the winter, and that a covering of some kind is highly beneficial. The rye accomplishes this very fully and when turned down in the spring affords an abundant supply of humus to the soil, thus keeping up its fertility and requiring only a moderate top dressing of some approved artificial fertilizer at planting time. No doubt crimson clover would still better answer this purpose, owing to the extraordinary root development. The single objection to it is that a good stand is not always obtainable unless the season is favorable. With the assistance of rye and crimson clover it is possible to keep tobacco land up to the highest point of fertility, without the aid of stable manure, if a little well selected artificial fertilizer is used in connection with them.

For two seasons past, tobacco farmers have been trying to produce a tobacco that is small in the leaf and which is now much in demand for binder purposes. Many of them have changed the time of topping the crop from the period when the seed bud makes its appearance, until a few days before the crop is housed. This is a most important innovation and promises excellent results. In this way the strength of the plant is no longer thrown into a few leaves within several feet of the ground but is evenly divided through all the leaves, only a few near the seed pods being removed. This plan while yielding smaller leaves, makes up in the greater number the weight that is lost by the inferior size.

The topping of the tobacco grown in this way is delayed until from three to six days of the time when it is removed from the field. Two drawbacks have developed thus far to the plan. The first is that the top leaves being more numerous and longer exposed to the sun, become thicker than the lower ones, which have been more shaded.

The second is that the stalk grows much higher and cannot be so well housed in the barns, the latter having been built to accommodate a certain number of tiers of shorter tobacco.

SPOTTING TOBACCO.

Nature seems to delight in exhibiting herself in varying moods in the vegetable world. The tobacco leaf is not an exception. Sometimes we find a field where the leaves are beautifully spotted or spangled with light colored spots. These are not a new thing. Whether the result of disease or insect attack or other cause is not known. In recent years much of the Sumatran wrapper leaf brought to this country is thus marked. It has attracted the attention of smokers, and these spotted wrappers have become a fad. There is a scramble for such goods at the Amsterdam sales, and they command much higher prices than the plain goods.

This fact has not been lost upon the tobacco growers of Pennsylvania, and for two or three years past they have been earnestly engaged in the attempt to spot their tobacco artificially. It was not until the present season, however, that a wide-spread movement in this direction was begun. Perhaps as many as 250 acres of leaf have been thus treated in the single county of Lancaster. In New England the fad has also taken hold, but with this difference, that while in Pennsylvania it is largely the work of individual growers, in Connecticut it has been undertaken by tobacco packers. A single firm has purchased as many as 200 acres when half grown, and treated the plants to the spotting process, near the period of maturity.

There is no special nor generally accepted formula. Many growers have devised their own. The one necessary requisite is some acid or caustic fluid that will, when thrown upon the leaf, eat or kill the fiber of the leaf and leave a white or cream colored spot, of varying size. Caustic soda, acids of various kinds and even petroleum are heavily diluted with water and then sprayed upon the plants, as evenly as possible. With the best care the spraying fluid is distributed unevenly on the leaves, while the spots vary much in size. The application is made generally about a week before the tobacco is cut. It should never be cut immediately after being treated, as the effect of the caustic fluid often causes the plant to wilt or sicken for several days, and time for recovery must be allowed. Generally, only one application is made, but some growers repeat the operation to insure a more uniform result. The spots do not seem to materially weaken the leaf, but are generally as tough as the part untouched. But the process has the tendency to thicken the leaf somewhat, and this is observed before, as well as after it has been sweated.

Whether this fad will last is a question. The continuance of the practice of spotting will in part depend upon that, and in part on the

prices that will be paid during the present season for that which will be thrown upon the market. If this domestic spotted tobacco finds favor in the eyes of cigar manufacturers, and large prices are paid for it, a step in the direction of more profitable returns for tobacco growers will have been taken.

NEW VARIETIES TRIED.

Another encouraging innovation is the experiments which were made during the past season, with types of tobacco that have not been planted in Pennsylvania before. This has not only been done by individual growers, but also at the Experimental Stations. At the latter Remedios, Vuelta Abajo, Partidas, Sumatran and some other varieties were tried on experimental plats. Some of these proved vigorous, very rapid growers, and promising. It is too soon to know the actual value of these goods. These experiments and the others carried on all over the State ought to produce good results.

A firm of Philadelphia leaf dealers last spring came into Lancaster county and made special contracts with many growers. They supplied gratis the seed of a famous Cuban variety of filler tobacco, the plants to be cultivated in a particular manner, and they agreed to take the resultant product at a uniform price of 15 cents per pound, unassorted. A good many growers entered into these contracts. So far it looks as if they would do better than those who made no contracts. The weight is less per acre, but this is more than counterbalanced by the greater price they get. Besides, being intended for fillers, as much care was not required in the field and still less in assorting.

CURING THE CROP.

The curing of the crop is quite as important a branch of the tobacco industry as growing it. It must be confessed that satisfactory progress has not been made in this direction. Growers are still disputing about the best way, and each one is a law unto himself. Less scaffolding in the field is done than formerly, and the stove is oftener brought into requisition to check profuse moisture. A judicious use of hot air at critical times is found of great advantage.

MARKETING THE CROP.

There has been no change whatever in the method of marketing the crop. This question is often discussed, but there have been no results. The New England growers have tried to market their tobacco by placing it in the hands of a committee chosen by themselves, but the innovation was so radical and the result so unsatisfactory, that it does not seem likely the experiment will be carried beyond the present year.

EXTENT OF THE INDUSTRY IN PENNSYLVANIA.

The tobacco industry reached its greatest development in 1879, when

fully 80,000 cases were grown. The product kept hovering near that figure until after the Sumatran invasion began, when the acreage began to fall off in consequence of low prices. This decline was greatly augmented in 1894-5 and 6 through the unfavorable seasons, the product being small in quantity and inferior in quality. Between the years 1890 and 1896 the acreage was reduced fully 33 per cent. and in some localities still more. During the season of 1897 there was, however, an increase of perhaps 25 per cent. over the acreage of 1896, and this brings us to the last crop.

THE CROP OF 1897.

The season of 1897 began under very favorable auspices. The weather at planting time was favorable, plants were abundant, and as a result there was an increase in the acreage, as has already been stated, of 25 per cent. The weather continued favorable the whole season through, save that a dry spell came along while the late tobacco was still in the field; this was slightly injured thereby, but the early harvested grew right along without hindrance or harm. The rains came at opportune times and fleas, worms, grasshoppers, rust and other drawbacks were almost unknown. During a period of 20 years a cleaner crop never went into the barns. The green tobacco worms, usually so plentiful, required less than the usual attention and did little damage. The result was that the crop showed a remarkable development of leaf, especially the seed leaf variety. The product of harvest time was estimated at from 80 to 90 per cent. over that of the previous year; since it has been cured it is found the increase in weight will not be as great as was at one time supposed. A field of two acres within the corporate limits of the city of Lancaster this season showed a development of leaf that was the most remarkable ever seen by the writer. For a week before it was harvested it was impossible to make one's way between the rows, so completely was the ground covered. Such large leaves of course must result in a heavy bodied tobacco, with strongly developed central and lateral ribs, and destroying its usefulness for wrapper purposes. Such is also the case with the greater part of the crop.

Up to the present time, January 1, 1897, comparatively little of the crop has been sold. During the curing process the dreaded white vein has made its appearance to a greater or less extent in almost every crop, and its value has consequently depreciated. The few hundred cases which have probably been sold up to the present time, have realized only from 5 to nine cents to the growers, although some few fancy lots commanded better figures. Whether there will be an appreciation in prices is of course uncertain, most probably not as the Wisconsin crop, which is very large, is selling from 4 to 7 cents and competes directly with our own. [April 1, 1898. When this article was handed

to the Secretary of Agriculture, three months ago, very little of the 1897 crop had been sold. Since that time affairs have taken a very favorable turn. The Cuban outlook and the attractive character of the crop have drawn attention to it. It began to move off very rapidly after January, first the seedleaf and then the Havana seed, until perhaps not more than from 5 to 10 per cent. of the crop remains in the growers' hands. Prices ranged all the way from 4 to 20 cents. Very many realized $100 per acre and many $150.]

THE CIGAR INDUSTRY.

The cigar making industry is so closely allied to the cultivation of tobacco, that some mention of it seems required here. Pennsylvania is to-day the largest cigar manufacturing State in the Union. There were during the last fiscal year, 31,401 cigar factories in the United States. Of these 6,352, or more than 20 per cent., are in Pennsylvania; 915 are in the single county of Lancaster. Of the total product of 4,048,463,306 cigars made in the United States, Pennsylvania produced 1,186,872,627, or 29 per cent. of the entire output. More than 20,000,000 pounds of tobacco were required to make these cigars. Of the 4,205 dealers in leaf tobacco, 599, or 14 per cent. of the entire number, are in our State; and of the number in Pennsylvania, 420, or 30 per cent. do business in Lancaster county. The cigar business like that of leaf tobacco has been very much depressed for several years, but there are indications of a revival of this industry to its former proportions. The number of men employed in the business is very large, while the capital invested is correspondingly great.

THE CIGAR LEAF CROP OF 1897.

Pennsylvania has grown perhaps from 70,000 to 75,000 cases this year. New England, in the aggregate about 45,000 cases of indifferent quality. Ohio about 55,000 cases, divided between Zimmer Spanish, Little Dutch and Seedleaf. New York shows up with 30,000 cases of perhaps average quality. Wisconsin this year is the champion state, so far as production goes, her crop being estimated at 100,000 cases, or perhaps slightly more. These estimates give a total of 305,000 cases.

THE FUTURE OF THE INDUSTRY.

This is not the place to speak about the moral aspects of tobacco culture. There will doubtless always be opposition to it as there has been since King James' day. Since the discovery of America, it has conquered the earth, like that other American product, the potato.

Governments regard it from an economic point of view, and have found it in the aggregate the greatest revenue producer in the world.

France, Italy, England, Spain and Germany derive annual revenues from its sale, running from $20,000,000 to $60,000,000 each. They could not get along without it. In our own country as much as $47,000,000 have been collected from it in a single year in the shape of internal revenue tax. During the past 25 years, over $900,000,000 have been put into the National strong box through its instrumentality. In addition we have exported for a period of years, an average of over $26,000,000 worth of tobacco and tobacco products. In Pennsylvania, the farmers have derived a gross revenue from the crop during the past 36 years amounting probably to $90,000,000 or more. This great sum of money was realized from a comparatively limited acreage. The outlay required to produce it was almost exclusively labor, and much of it the ordinary labor of the farmer and his family. Most of this money has come from outside the State. Its coming seems to represent a clear gain to agriculture.

In view of this statement of facts, tobacco growing seems as likely to remain an agricultural crop in our State as wheat and corn are. The inexorable logic of facts carries conviction with it. A decline in prices below the cost of production may temporarily operate as a setback to the industry, but its permanent cessation is a question hardly deserving of consideration.

SEX IN PLANTS.

By JOSIAH HOOPES Esq., *West Chester, Pa.*

But a very small percentage of our agricultural community are acquainted with the organs of reproduction in plant-life, although thoroughly conversant with the laws that govern the procreation of the animal world, and the necessity of careful selection when increasing their flocks and herds. Although presented in as practical a manner as possible, the writer is desirous of disclaiming any idea of originality in the present paper, rather depending upon his personal observations, extending over a long series of years, whilst following in the footsteps of the great leaders in structural botany. That there is quite as much importance attached to the selection of parents in the plant world as there is in the animal kingdom, is a self-evident fact, thoroughly and satisfactorily proven by experiments which admit of no doubt whatever.

The genesis of life is a single cell throughout all organic nature, and

the sexual laws by which the vegetable world are ushered into existence, are justly entitled to our most careful investigation and study. We cannot, with exact certainty, control all the various attributes of the offspring in plant life, but by a judicious selection of parentage, we may feel reasonably certain that a portion at least of the desirable qualities of the parents can be transmitted to their offspring. To understand this subject properly, it will be necessary to briefly describe the various parts of a flower, those organs instrumental in the formation of seed, together with the methods in vogue for influencing the character of a new race of plants. As this paper purposes treating only of the essential organs of plants, i. e., those necessary for generating their kind, all other portions of the plant will have to be passed over without extended remarks, although many species have the power of reproduction by means of underground stems or stolens, bulblets on the stem, etc.

Taking for example the flower of a cherry, we have presented an apt illustration of the subject. In the centre may be observed what is known as the pistil, corresponding to the female sex, and composed of the ovary, a rounded body at the base, wherein is enclosed the ovule or embryo seed awaiting fertilization.


Half of a Cherry-blossom. Illustrating all the essential organs. (After Gray).

The stem of this organ, known as the style is porous or a hollow tube, as it were, offering a passage for the pollen or dust-like particles necessary for fertilizing the ovules. At the summit of the style is a cap or stigma with a rough surface, covered with a glutinous substance that holds tightly any foreign object that may chance to lodge thereon. Unlike other parts of the reproductive organs, the stigma has no skin or covering of any description, but is merely composed of loose tissue.

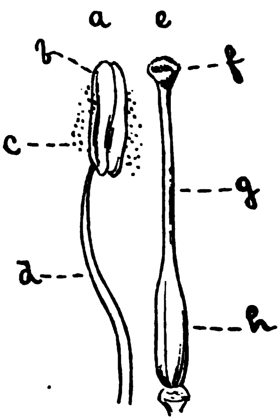


Fig. 2. Essential organs of a Lily (Lilium).
a—Stamen. b—Anther. c—Pollen d—Filament. e—Pistil. f—Stigma. g—Style. h—Ovary. (After Gray).

Clustered around this pistil are the stamens, corresponding to the male organs,

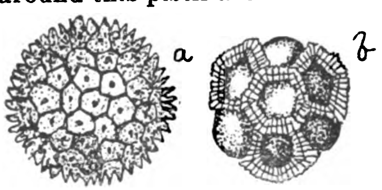


Fig. 3. Pollen grains, highly magnified.
a—Morning Glory (Ipomæa purpurea). b—Black Oyster-plant (Scorzonera Hispanica).

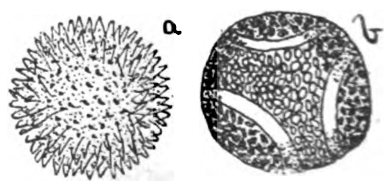


Fig. 4. Pollen grains, highly magnified.
a—Hollyhock (Althœa rosea). b—Passion flower (Passiflora carnlea).

and may be described as follows: Upon a stalk or filament is located the anther, a little case containing the fertilizing material known as

the pollen. The latter, when mature, is discharged through slits in the sides of the anther, and the minute particles falling on the glutinous cap of the pistil, are gradually drawn down the orifice of the style to the ovary, where they fertilize the ovules, and the maturing process commences at once. These pollen grains are usually rough in exterior to enable them to hold on tightly to any object where they may be cast.

The microscope enables us to investigate the process of fecundation in an exceedingly interesting manner. A pollen-grain is really an accumulation of cells enclosed in two coverings, the outer one thick and the inner thin. When the pollen grain alights on the stigma of the pistil, the inner coat at once prolongs into a tube and pushes its way through one of the minute slits or pores of the outer covering. These pollen-tubes are capable of great extension, and continue increasing in length on their downward course through the style until they reach the ovary. Here, the life-giving principle, called fovilla, is discharged, and when it enters the ovule the latter rapidly increases in size, the little embryo plant is created, and the seed for a succeeding generation of plants has been perfected.

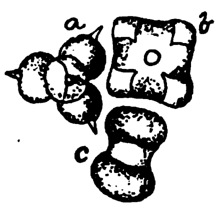
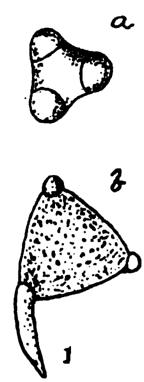


Fig. 5. Pollen grains, highly magnified. a—Common Rush (Iuncus Sp.). b—Flax (Linumusitatissimum). c—Cedar of Lebanon (Cedrus Libani)

Fig. 6.



Pollen grains, highly magnified. a—Willow Herb (Epilobolum Sp.). b—The same with pollen-tube, passing down the style to the ovary.

The pistil, or female organ, is beyond a doubt the most important part of a flower, as all others are subservient to it, and in some way assist in protecting and developing its functions. In most species of plants the male and female organs in their immature state, are enveloped in various colored flower leaves known as petals, and in a complete flower these, in their turn, are protected by green leaves known as sepals, or the calyx. There is such a very great diversity in the form of our various flowers that the student of plant-sex should carefully investigate this very important feature before entering upon the practical application of his knowledge in the work of cross-fertilization. Whilst some specimens have but a single pistil, others are supplied with a large number, and the same arrangement applies to the stamens.

Just here it will be as well to bear in mind that an imperfect flower is one deficient in either stamens or pistils, the necessary essential organs, and an incomplete flower is wanting in either calyx or corolla, the latter not being necessary in the formation of seed.

Not only is there a decided difference in the number of essential organs in the various species, but there is a well-marked distinction in their arrangement or plan, all of which must be closely observed when studying the reproduction of plant life. Perhaps the most important, and, at the same time, perplexing disposition of the essential organs is that known as dioecious, where the male and female organs are in separate flowers, some blossoms containing staminate or male organs, and others supplied with pistillate or female alone.

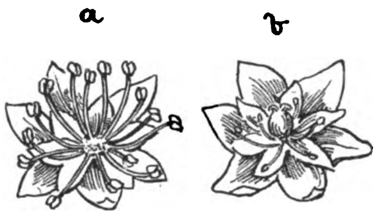


Fig. 7. Moonseed (Menispermum Canadense), illustrating diœcious flowers.
a—Male or staminate flower. b—Female or pistillate flower. (After Gray).

This arrangement may occur in the same plant, or in separate individuals. Again, there are species termed polygamous, where some flowers are perfect, and other either staminate, pistillate, or neuter, the latter having neither stamens or pistils are consequently incapable of producing seed.

The disputed point among horticulturists regarding the sexes of strawberries can only be explained in one way. There are no strictly pistillate plants without stamens. This is a self-evident fact, as the female organs cannot produce fruit, and consequently seeds, without the aid of pollen from the stamens. Of course they may be fecundated by the male organs of other varieties, with the assistance of insects, but that all strawberries are provided with stamens, although sometimes quite rudimentary, is a well-proven truth, so that all so-called purely pistillate varieties can and will produce seeds without the intervention of other sorts. True, some flowers in many plants are deficient in pollen, so that it is advisable to set other kinds abundantly provided with these essential bodies in close proximity.

Fig. 8. Flowers of Scotch Pine (Pinus sylvestris), illustrating a monœcious plant.
a—Male or sterile flowers. b—Female or fertile flowers.

The greatest practical benefit to be derived from a thorough acquaintance with the sexes of plants is the assistance it affords in our experiments in hybridizing species or cross fertilizing varieties, for the purpose of originating new forms. The common method of collecting seeds indiscriminately, relying on insects to perform the indispensable work of impregnation, is useless, even when the plants are

growing near together. In most cases, the essential organs of a flower perform the task assigned them in preference to aid from other flowers, so that the only certain method to obtain a cross is by removing the stamens, and supplying the pistil with pollen taken from another plant.

In the entire range of horticultural duties, there is not one so fraught with interest nor any requiring a deeper insight into plant-life, than hybridization, but the novice must understand at the very outset, that a thorough and a practical knowledge of the sexes of our plants is an absolute necessity to insure success. In selecting a natural order of plants for our experiments, there are none that afford a wider field of usefulness, nor one that is more readily manipulated, than the Rosaceae, which embraces a large proportion of our edible fruits, and some of our most valued ornamental flowers. Here, we can select the apple, pear, peach, apricot, plum, cherry, quince, strawberry, raspberry, blackberry, etc., with the queen of flowers, the rose. By referring to our previous description, of the essential organs of plants, the inexperienced student will notice the female portion of the flower, or pistil, is situated prominently in the center, with the male organs, or stamens, clustered around it. As there is a marked difference in the constitutional ability of some varieties to produce seed, it is advisable to select the most vigorous, healthy and reliable kinds to serve as the female parent. For instance, among roses, the General Jacqueminot, of the Remontant or Hybrid Perpetual class, produces a remarkable abundance of hips, or berry-like fruit, and is, therefore, admirably fitted for the purpose. The selection of a suitable variety to act as staminate or male parent, is really of little consequence, so far as the mere accomplishment of impregnation is concerned, but it should receive due consideration in our effort to produce a new form, embodying certain requisites that we are anxious to perpetuate.

A few years since, whilst engaged in making a careful microscopical examination of the pollen-grains of the apple, with a view to ascertaining the cause of failure in many varieties, it was interesting to note that several of these pollen-grains were abortive, and consequently useless for self-impregnation, and yet in some varieties, noted for their productiveness, the above were remarkably abundant and apparently unusually healthy and vigorous. The Right Hon. Lord Penzance, who has succeeded in raising a new race of roses, by crossing some of the old-fashioned garden sorts on the Sweet Briar (Rosa rubiginosa), and in the course of his experiments, he states: "I have since found out what I did not anticipate, that it is a first rate seed flower and more certain to bear fruit, when fertilized with the pollen of other roses, than any other roses or class of roses, in my experience.

has presented itself." At the present time there are many interesting experiments in progress, with the Rosa rugosa as the female parent, and the results so far are exceedingly encouraging. In this connection, it may not be out of place to particularize the work of Mr. Jackson Dawson, of the Arnold Arboretum, whose success with the Rugosa hybrids has been almost phenomenal. The writer noticed in a recent visit, one particular seedling having the General Jacqueminot as a male parent, and the result was a Rosa rugosa in growth and foliage, with the brilliant crimson color of the former. Other crosses were equally as important to the rosarian. Hybridizers seem to have ignored the claims of our fruit interest in a measure, although here is a broad and inviting field for intelligent work. The wonderful achievement of Mr. Burbank, of California, in obtaining so many valuable new hybrids and cross varieties of fruits, is sufficient proof of the importance of operating with a distinct object in view, instead of depending on chance seedlings that may or may not result favorably, with the chances greatly in favor of the latter.

The operation of artificial fertilization is neither difficult to understand or perform. After a judicious selection of the two parents, it consists merely in removing the male organ from the flower with the aid of a pair of sharp-pointed scissors. It must be borne in mind that this should be accomplished before the anthers are ready to discharge their contents.

If delayed too long, our work of artificial hybridization will be useless, for should a single grain of pollen fall on the stigma, all idea of crossing must be given up. After the stamens have been removed from what is intended to be used as the female parent the stigma of the pistil must be impregnated with pollen from the selected male parent.

This is accomplished with the aid of a soft camel's hair brush, which will collect the pollen from the anthers and deposit it upon the pistil, where it will be firmly held until gradually drawn down to the ovaries. After having effected the artificial fecundation, the flower must be covered securely with light gauze so that all risk of outside interference may be avoided. The work of insects must be always borne in mind, owing to the persistance of these little busy-bodies in collecting honey, and at the same time carrying pollen-grain from one flower to another; indeed, the largest proportion of cross fertilization is so performed, but of course, we are unaware of the true parentage in such contingencies. When artificial impregnation has proven successful, the ovaries commence developing, and soon mature, but if the reverse should be the case, the embryo fruit turns yellow, and soon drops from the branch.

To properly understand the sexual organs of plants, it is necessary

to investigate their sexual character, as well as the metamorphuses they are liable to undergo. A flower is but a modified branch, the several parts of which are liable at any time to be transformed into stems and leaves. For instance, so-called "double flowers," as garden varieties of the rose, are really metamorphosed stamens developed into petals, but in almost every instance there are sufficient male organs remaining to perform the function of frutification, the pistils mostly continuing intact. An interesting example of this transformation may be seen in the "Green Rose," an old time variety, now rarely grown, excepting in the collections of curious freaks, where all the petals have been changed into well marked green leaves. This foliaceous monstrosity, by many years of cultivation, has become fixed, and the unique spectacle of apparently green flowers may afford gratification to lovers of novelty, but not to the naturalist who is gratified alone with Nature in her legitimate form.

Fig. 10. Green Rose (Viridiflora), showing the transformatioh of the essential organs into green bract-like leaves.

The arrangement of sexes in our various cultivated plants, forms a helpful and interesting study, but without first mastering the principles of structural botany, it is impossible to turn our knowledge to a practical use. The subject is far too extensive to describe in detail here, but it may not be out of place to revert to the reproductive organs of a few of our trees and plants, those most valuable to the agriculturist, with a view to originating new and improved varieties. In this paper, we have already alluded to the fruits belonging to the great Natural Order Rosaceae, and as their flowers are very simple and easy to understand, it is unnecessary to reiterate our remarks, excepting to impress upon the novice how essential it is to select a parentage on both sides embodying the most desirable qualities that one could hope for in the offspring.

A very interesting genus to the hybridizer or student or morphological botany, is found in the Vitis, or grape family. In the American species, the flowers are what are termed dioecious-polygamous, that is, the sexes are produced in different flowers and on different plants, and some are hermaphrodite. A curious feature, is the arrangement of the petals, which are loosely fastened at the top (coherent), and separated at the base, causing them to fall before expansion, and permitting the essential organs to stand out in full view, when they may readily be manipulated by the hybridizer. A broad and most interesting field of experiment

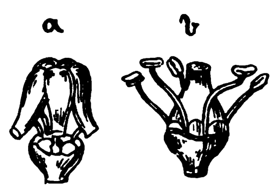


Fig. 9. The Grape (Vitis), polygamous in our native species. a—Flower opening, petals slightly coherent at the top. b—The same, with petals fallen. (After Gray).

is here offered to the student, as our own native grapes combine so many valuable requisites, needing only that of a superior quality to make them perfect.

Original experiments with the potato and tomato, for they belong to the same natural order, Solanaceae or nightshade family, should claim our most careful attention, as too many of the newer varieties are merely the result of chance seedlings without any knowledge whatever of their paternal origin. The various genera belonging to this natural order are provided with regular flowers, having five stamens, and composed usually of five parts. Stamens many, protruding beyond the orifice, and united with each other. In the potato, the anthers are inserted on the corolla, and open at maturity by two terminal pores. Very little difficulty is experienced in accomplishing the operation of cross-fertilization in either of the above two esculents. Their essential organs are arranged so conspicuously that the stamens may readily be removed before the anthers are prepared to discharge their contents. The solitary pistil or female organ is also quite conspicuous and easily fertilized.

Although foreign to the subject of sexes in plants, the writer cannot refrain from alluding to the necessity of carefully selecting the finest formed and perfect tubers of the potato to plant for the succeeding crop. This esculent is to all intents and purposes a mere underground stem with buds (eyes), and bracts answering to leaves, so that when the tuber, or any portion thereof, is planted in the soil, growth commences similar to a cutting taken from an ordinary branch above ground. It may, therefore, readily be seen that to secure the best results, the finest tubers should be selected for propagating purposes, the same as a good gardener chooses the strongest and most promising limb to perpetuate his trees and plants.

There is a phase of this subject with which we have nothing to do in this place, although not devoid of interest. The question of whole or sections of a tuber, for planting purposes appears to have strong advocates on either side, but it is not unlikely that results are governed more by the quality of the soil and care in cultivation than in the actual size of the seed-potato.

We now arrive at an important feature closely connected with the subject of sexes in our plants, and one which exerts a wonderful and mysterious influence upon the succeeding generation. It is what gardeners term "fixing" a sport or variation from the original type. Occasionally, from some unaccountable cause, one may notice a peculiar deviation from the characteristics of the parent, and if worthy of cultivation, the gardener's skill is taxed to develop and perpetuate it. If it is a hard-wooded plant, the usual systems of grafting, layering, etc., are resorted to, and the desired end is accomplished with little trouble, but if it should be a herbaceous annual plant, to be increased

by seeds alone, then nothing short of several years of constant care can produce the desired result.

It is a well known fact that all vegetation possesses an innate power to sport into distinct and occasionally improved forms. We cannot explain this physiological truth, but we know that these modifications may become in time so permanent, that their seeds will produce exact representatives of the original type. The system pursued by seed-growers abroad, as well as at home, in fixing chance varieties from the primitive source, requires intelligence, patience, close attention to details and more than all, an inborn love for plants. Seeds produced by an accidental sport will frequently revert back to the normal condition, without a solitary specimen showing the peculiar characteristics of its parent, although it is usual for some of the seedlings to present some little change from the usual form. In a bed of young plants of this character, it is necessary to immediately remove all specimens that have reverted back to the type, and carefully preserve the seed of those which approach our ideal of the new departure. The second season's experience will, as a rule, be more satisfactory, but the same attention to removing unremunerative seedlings, will be quite as necessary.

A gradual setting of the type, will after this become apparent, although it will be indispensable to watch closely for variations, owing to the fact that all plants show a marked propensity to return to their normal condition. These variations from the type are remarkable in many ways, and are not confined to regularly formed single flowers, as the artificial or unnatural double forms are just as liable to sport into a variety of colors and shapes.

This change in our cultivated plants is brought about by a variety of causes, such as sterility in the soil, or, on the other hand, a plethoric state owing to a surplus of stimulating material; or, it may be of atmospheric origin altogether, the environment in any case tending to create the new variety which most plants are seemingly always ready to produce under satisfactory conditions. Any of these circumstances will frequently induce a flower to undergo the morphological change known to florists as "double flowers," the nature of which has been previously explained in this paper, so that the cultivated species that has no variety with numerous petals in place of stamens, is the exception to well regulated laws.

Such monstrosities as double flowers of tulips, fuchsias, lilies, convalarias, etc., are cases in point, but fortunately the tendency of the public taste is now towards the flower in its natural condition, as is instanced in the demand for single dahlias, cosmos, etc.

Perhaps the most curious feature in this variation of plant-life is to be found in the change of color, that almost invariably results after any plant has sported into some tint differing from the type. The

mere act of setting this sport seems to exert an influence on the flowers of succeeding generations, and it is usual to find variations of every color in a few years. The truth of this assertion may be tested by simply glancing over the pages of our seedsmen's catalogues of to-day and comparing their lists with those offered a few seasons past. In fact, judging from the experience of our skilled plantsmen in this line, nothing is too difficult for them to accomplish.

The old-fashioned small petunia flower of our boyhood days, representing but one, or two at most, colors, can now be produced in almost every conceivable tint, relieved by the most intricate veinings and lovely shading, and withal, as perfectly double as the most enthusiastic florist could desire. This is but one instance out of very many, as scarcely one of our garden flowers can be named that has not passed through the same artificial process, to please the taste of lovers of novelty, for we cannot truthfully add, beauty.

Variation in every direction is constantly changing, either becoming more perfect or returning to the normal state. And here is where the skill and watchfulness of the expert is most needed. The moment a retrograding specimen is noticed, the plant must be removed, for fear of contaminating the improved strain, whilst the tendency of these flowers is along the line of gradual improvement, or rather towards an intensified type of the original sport.

There is actually more hope of obtaining a valuable new form from these variations than from a plant in its natural state, as the mere effort of alteration or modification appears to act as an incentive to produce other distinct departures.

The production of new grasses, of which wheat, oats, rye, etc., are familiar examples, are not tractable to the hybridizer, owing to the numerous flowers being arranged so compactly on the terminal spike, and yet working on the principle of high cultivation and careful selection for a series of years, new and improved forms are constantly being originated and placed on the market. The cross-fertilization of Indian corn, however, which is likewise another member of the Gramineæ, or family grasses, is attended with comparatively little trouble. This valuable plant, the Zea Mays of botany, is monæcious, that is having staminate and pistillate flowers distinct, but borne on the same plant. The male spicate racemes known as the tassel, are terminal, and in preparing our work of hybridization should be removed, before the stamens are matured, thus leaving the female or pistillate spikelets, known as the ears, to be fecundated by pollen to be procured from other related varieties. To produce a perfect cross with some desired form, pollen from the latter must be shaken on the silk, or to speak technically, the long capillary styles which are exserted from the envelopes of the spike, and forming at maturity, the well known ear of corn. This systematic work of producing new

varieties of Indian corn is not only exceedingly interesting, but of the greatest benefit to our farmers, and cannot fail to prove successful, if proper care is exercised in making the cross.

It must be borne in mind, however, that a single unwelcome pollen-grain will destroy the value of our intended new form, and to prevent this, immediately after the embryo ear of corn has been pollinated, it should be loosely encased in light gauzy material. We may reasonably expect to secure the good qualities of any two varities by this system, as for instance, extreme earliness from one parent, and large size from the other; or in the case of sweet corn, we may possibly combine earliness with a sweet delicious flavor, an improvement greatly to be desired. There is a marked difference in the susceptibility of various species of our plants to cross fertilize each other. Although some may be planted in close proximity, without any danger of destroying the purity of the crop, there are others that seem to mix and sport into a variety of forms and colors, even when the greatest precaution is taken. The Aquilegia or Columbine, among ornamental flowers, and the pea among esculent plants, are excellent illustrations of the latter. There is no sure way of preventing contamination excepting by planting the several kinds a considerable distance apart, and even under such circumstances bees and other insects will carry the pollen from one to another.

There is a striking feature in the similarity of the reproduction of animals and plants which has been well proven by Darwin and others, and that is, the decided advantage to be gained by cross fertilization in plants and cross-breeding in animals. It is undeniable that Nature is constantly endeavoring to produce cross-fertilization throughout the entire range of both the animal and vegetable creation. It is indispensable for the best interest and welfare of her subjects; indeed, in some species of flowers, they really seem unable to fecundate themselves effectively without the assistance of insects, as for instance, clover, or the well-known yucca. In and in breeding in every instance, tends to deterioration, and cross-fertilization increases the vigor and health of the plant or animal. Few farmers but what are aware of the necessity of occasionally changing their seed of grain or esculent vegetables, but do they really know the underlying principle that causes this necessity. It is not merely a change of soil, but is owing in a great measure to a deviation from the same generation of self-pollinated plants. A change becomes a needful event in the life and well being of the plant, and in consequence of this change, succeeding generations are imbued with renewed health and vigor. Careful experiments have proven the truth of this statement beyond a doubt, and it would be well for our practical agriculturists to frame their plans accordingly.

The possibilities of hybridizing any and all our fruits, thereby pro-

ducing new and improved forms, is beyond question, as has been repeatedly proven by Mr. Luther Burbank, of Santa Rosa, California. After years of patient labor and experiment, he states: "There is no barrier to obtaining fruits of any size, form or flavor desired, and none to producing plants and flowers of any form, color or fragrance; all that is needed is a knowledge to guide our efforts in the right direction, undeviating patience and cultivated eyes to detect variations of value." This eminent scientist and horticulturist, by strict attention to the principles which govern growth, and a knowledge of the relationship existing between certain allied genera of plants, has succeeded in originating entirely new and distinct races, showing in some instances very little affinity to their parents. Occasionally, the characteristics of but one parent is noticeable, but by far the greater portion of such hybridized seedlings possess the distinguishing marks of both ancestors. Incidentally, the seedlings will show some marked character at the outset, and then, without any apparent cause, they will break into the most curious and eccentric forms imaginable, so that it is very important to thoroughly test these new creations until their characters are fully established.

In testing the value of the male parent, we cannot be certain that the progeny will inherit any of its peculiar or distinguishing marks, although we may reasonably hope to secure a portion of them. Mr. Burbank says, in this connection: "Tomatoes may be grown from seed pollenated from potato pollen only, and Juglans regia from nuts pollenated only from Juglans cinerea or J. nigra. The common Calla has often been grown from seeds pollenated only by Calla albo-maculata; also pure wheat from rye pollenations, and vice versa; pure blackberries, raspberries and dewberries from apple, rose, quince or mountain ash pollenations. Seedling lillies very rarely show the effect of foreign pollenation, though often producing seed much more abundantly than with pollen of the same species. These facts have been observed by me so often, and have been worked on so extensively, and can be proven so readily that the common theory of parthenogenesis must, in these cases, be set aside. There is no barrier to obtaining fruits of any size, form or flavor desired, and none to producing plants and flowers of any form, color or fragrance; all that is needed is a knowledge to guide our efforts in the right direction, undeviating patience and cultivated eyes to detect variations of value."

Hybridism not only causes a change in flowers and fruits, but also in the plant itself. Mr. Burbank describes and illustrates some most remarkable instances of this, which he originated in the raspberry and blackberry, where the stems are of almost every imaginable tint, from pure white to purple and even black; and while some are furnished with very few rudimentary prickles, others again are clothed with formidable sharp spines, in addition to all the intermediate

grades. This is particularly noticeable in a lot of blackberry canes crossed by the raspberry, where all were raised from seed of one plant, and yet the most wonderful diversity in color of bark and prickles were grown. The foliage sports into an almost endless variety of shapes, from the finely dissected fern-like leaf, to an intensified character of the parents.

In summing up the different phases of this interesting subject, with a full appreciation of its great importance, especially to our farmers and horticulturists, the writer may well ask whether he has explained the matter in an entirely lucid manner, so that his readers may profit by his advice. The whole question is as yet but imperfectly understood, as the laws governing the reproduction and growth of plants, are subject to so many contradictory results in the hands of our scientific experts; but gradually, the apparent mysteries are being unravelled, so that we may confidently hope for a more enlightened condition of the subject for future experimenters.

No one should attempt the improvement of our fruits, without first studying all the various features connected with sex, and then selecting the parents with a discriminating eye as to desired results. The mere crossing of two well known garden or orchard forms, rarely re pays us for the trouble, but by selecting some one of our finest varieties of fruit for the male parent, and pollenating a hardy native species, it is really wonderful what may be accomplished. Disappointment may very possibly ensue at the first attempt, but by steadily persevering, success will assuredly crown our efforts.

Occasionally it is found beneficial to use the seedlings of the first generation as mother plants, for a new race, which may be improved by pollenization from some variety of undoubted excellence. Impatience and discouragement should never be permitted to divert our attention from the slow and tedious, but intensely interesting work in hand, as it may require several years to develop some highly improved variety, that the hasty experimenter might be tempted to prematurely cast aside. To the botanical student, scientific investigations of this character offer unexcelled advantages for prosecuting his research in the way of sexes in plants. The practical hybridizer obtains more information in the practice of his favorite pursuit than he could possibly acquire from any other source, even from the best technical treaties on the subject.

In conclusion, I wish to appeal to the young men of our Commonwealth not to rest satisfied in merely following in the footsteps of their fathers, but to search out and originate methods for their own guidance. The field for original research is vast, and the amount of good that such investigation may accomplish is beyond calculation. Whilst writing this paper, the temptation to branch off from the strict letter of the text, sexes in plants, has been exceedingly difficult to

overcome, owing to the many important side-issues which have constantly claimed attention. That these have been ignored was not from a sense of their subordinate position, but from a feeling of duty to adhere as closely as possible to the original topic.

THE FUNGOUS FOES OF THE FARMER.

By PROF. BYRON D. HALSTED, D. Sc., *New Brunswick, N. J.*

The farmer has many foes and the fungi are not among the least of them. They begin their destructive work at the opening of the growing season and do not close their activities for winter until late in the autumn. They thrive upon every crop the farmer grows from the smut in the corn to the mildew upon his lettuce, from the potato rot to the rust of the wheat and the blight of the apples and pears.

These fungi are obscure, because usually so very small, and a full knowledge of them is gained only after prolonged study with the compound microscope. They are, in short, minute plants that have no roots, stems or leaves and consist of fine threads that increase in length often with considerable rapidity and may form structures of considerable size by the filaments uniting with each other like the fibres in a rope.

Among the more conspicuous fungi are the mushrooms, toadstools and puff balls that appear in the pasture or upon old logs. If a toadstool is examined it will be found to consist of the stalk and cap, the latter with many gills upon the underside reaching from the top of the stalk to the rim of the cap. Upon these gills small oval bodies are produced in great numbers. In some toadstools the gills are brown or pink, white or almost any other color, depending upon the tint of the spores. This can be determined with ease by removing the cap and placing it upon paper where the spores will fall in a few minutes in sufficient numbers to give a "print" of the gills. If the spores are white a black paper is best to show them, and a white paper for the same reason is best when the spores are dark. The color of the mature gills will suggest the best paper upon which to lay the caps in making these "spore prints."

The above illustration is given in order that the reader may gain

The six engravings herein used, first appeared in the reports of the New Jersey College Experiment Station.—B. D. H.

a practical lesson, if he will, in the great numbers of spores that fungi produce. These spores are the reproductive bodies of the fungi, and while exceedingly small vary greatly in many ways. They answer to the seeds in higher plants and while differing from seeds in their structure, size, etc., are able, under favorable conditions of developing into new plants similar to the ones producing them.

There are many kinds of plants aside from fungi that produce spores instead of seeds and all such are flowerless and therefore never have any blossoms. Among the large plants that bear spores are the ferns, some of which attain to the size of trees in the warmer regions of the globe. With us the ferns are herbs of good size, and if the reader will examine them the spores may be found upon the underside of the large leaves in small spots of various shapes and known as the spore-spots. Other ferns have the spores produced along the infolded edges of the leaves, and in some the spore-bearing leaves are quite different from those that never produce them.

The mosses form another large group of very leafy green plants that have no flowers and form the spores in small cups that are produced upon the tips of slender stalks. Another group of spore-bearing plants is the scouring rushes or horsetails. Enough has been written to show that the fungi have related groups of plants, all of which agree in bearing spores instead of producing flowers and seeds.

Fungi are not easily defined and with the preliminaries as above stated a further knowledge of them will be given by means of examples, the selection being made from those that are the most troublesome to the crop grower.

Fungous Foes of Farm Crops.

The corn smut (*Ustilago maydis* Pers), is a well known fungus enemy to the farmer which appears upon the ear, tassel, leaves and even stems and roots of the corn plant. Multitudes of brown spores are produced, and it is these that make up the brown powder so abundant when the smutted ear is dry. As in the toadstool so here there are two chief portions of the smut fungus, namely, the threads and the spores. The latter remain over the winter wherever they may chance to lodge, and if surrounded by favorable conditions for germination will produce threads in the spring. It has been determined that a rich moist warm situation like a manure heap is an excellent place for smut spores to grow and they there produce multitudes of other spores which, when they find their way to the young corn plants, will inoculate them with smut. These spores falling upon the surface of the corn leaf or young stem, will germinate and send their slender threads into the substance of the plant, and when once within they thrive upon the juices there found, of course, at the

expense of the young corn plant. After some time, and it may be weeks, the fungus prepares for a spore production, which as a rule takes place in the young grains, but other places may bear the sooty masses of spores as the tassel, bases of the leaves, etc. The young grains, already infested with the fungus, enlarge rapidly, become greatly distorted, break out through the husks and the dropping ear is a mass of smut not unfamiliar to farmers.

From the nature of the disease and its habits of wintering and germination in the spring it is evident that the first thing to do in checking the trouble consists in destroying the spores as fully as possible. This may be done by cutting out the smutted ears, tassels and other parts of the corn plant and burning them. It would be worse than useless to cast the smutted portions into the manure heaps, for there the spores germinate and multiply greatly, producing spores in the most favorable place for transportation to the field when they would be quite certain to reproduce the smut upon the corn.

Spraying, to be considered later, is not practicable with this fungus, and the method suggested above is the one to be pursued.

The smut is sometimes very prevalent upon sweet corn and then it may be necessary to grow other crops for a term of years upon land long in corn that has become much contaminated with the spores.

Nearly all the small grains are now attacked more or less with smut, that upon the oats (*Ustilago Avenae* Jen.), being perhaps the most common, and taking the whole country through shortens the oat crop considerably. This fungus makes its attack upon the plant when the latter is small—while it is a seedling, and by spores that are adhering to the grain. From these facts an effective and cheap remedy has been worked out consisting in the destruction of the smut spores that may be upon the seed grain at time of sowing. The oats to be sown are placed in water hot enough to kill the spores and not injure the grains. This is known as the Jansen method, from the Danish discoverer and may be employed upon a large or small scale, according to circumstances. Two vessels are employed for holding the water, one with a temperature of 130 degrees and into this the dry oats in gunny sack or basket are placed until heated throughout the mass. From this vessel the oats in the sac or basket are taken to the second vessel where the water is kept uniformly near and not above 135 degrees and left to scald for fifteen minutes, after which the grain is spread out to dry and then sown or stored until needed for seed.

The wheat smut (*Ustilago Tritici* Jen), is similar to that of oats in that its spore-bearing portion is confined to the grains and therefore seems to affect only the heads of the wheat, while in fact the plants become inoculated through the seedling stems close to the ground.

and the whole stool is infested, discolored and dwarfed by the fungus. The same method of treatment as for oat smut is now used with marked success, but on account of less covering to the grain, a somewhat lower temperature is best, not heating the water in the second vessel above 127 degrees F. In employing this method a thermometer should be in constant use to determine the temperature of the water in the vessels, for if too low the spores will not be killed and if too high the grain will be injured.

Other methods of destroying the adhering smut spores have been in use for a long time, as for example blue stone (copper sulphate), one pound in twenty-five gallons of water in which the seed wheat was soaked for a half hour or less. The latest recommendation for oats is the use of a solution of potassium sulphide in one half per cent. solution, that is, a pound to two hundred (25 gallons) of water.

Ergot (*Claviceps purpurea* Tul.), is the most remarkable fungus of the grain fields. Its favorite plant is the rye, but may appear in wheat, barley and many of the grasses, and always confines itself to the heads when it causes the grains to become greatly enlarged and hard as horn. Upon the rye these grains, from their resemblance in size, shape and hardness to the spurs of cocks, have received the common name of "spurred rye." These spurred grains several times the size of the natural grains possess the very active principle, ergotine, that may cause disease (Ergotism), and death in animals and man. Ergotism is quite abundant in some countries, but there is but little of it as a rule in the United States.

Fungous Foes of Root Crops.

Among the root crops of the field and garden there are several fungous diseases of great destructiveness. The club-root of the turnip is caused by a slime mould (*Plasmodophora Brassicae* Wor.), and receives its common name from the fact that abnormal enlargements of the roots are produced and the plant's feeding capacity is so reduced thereby as to cause ruin. The fungus is without filaments and multiplies in the cells of the roots, causing them to grow out of the natural shape and soon decay with a very disagreeable odor. The fungus resides in the soil and therefore any treatment that is given needs to be applied to the soil, instead of the plants. It has been found that upon land that is infested with this disease slaked lime is quite effective applied to the soil at the rate of seventy-five bushels per acre. This application may be made the autumn before and left upon the surface until plowed under in the spring.

Cabbage is equally susceptible with turnips to this club-root and the failure of this crop may often be traced to this cause. The same

soil treatment is advised as for turnips, and it goes without argument that when a piece of land fails with a crop of turnips by clubbing it should not be followed by cabbages, unless thoroughly limed.

Fig. 1 – Young Cabbage Plants—Showing Club-root in a Serious Form.

Figure 1 shows three young cabbage plants that are badly clubbed, the engraving being made from a photograph of the diseased plants.

The sweet potato has several fungous diseases that work upon the roots, the leading ones being the Soil Rot, the Black Rot and the Soft Rot. When affected with the soil rot the plants show a lack of vigor and an examination of the roots reveals the certain marks of the disease. The roots attacked when young and fibrous become constricted and dark at a few places and are somewhat necklace formed. Roots also of considerable size may have brown, sunken patches where the fungus has destroyed the tissue of the potato. The soil rot germs are in the earth and a field crop may become so infested as to make sweet potato growing unprofitable upon that land.

A number of substances have been tested in seeking for a remedy, but none of them give such favorable results as flowers of sulphur

sprinkled in the open row where the plants are to be afterwards set. This powder, at the rate of three hundred pounds per acre, can be added rapidly with the ordinary fertilizer drill, and along with the fertilizer if any is applied.

The Black Rot (*Ceratocystis fimbriata* E. & Hals.), as its common name indicates, produces dark markings upon the sweet potatoes and may spread with age and include the whole root. It begins in the hot bed and is recognized upon the sprouts as dark lines near the base. All such sprouts should be rejected and great care taken that only the most healthful roots are used for the production of sprouts.

A third form of rot of the sweet potato is produced by a mould (*Rhizopus nigricans* Ehrn), that develops rarely before harvest but often to a great extent in the storage bins. This fungus thrives in moisture and the time of greatest destruction is while the potatoes are passing the sweating period. To save the roots at this time it is well to have the store room thoroughly ventilated and kept to about seventy degrees by means of artificial heat. This dries off the moisture that gathers upon the roots and the mould is less apt to start. When once it gets into a bin or barrel it runs through the potatoes with amazing rapidity, reducing them to a soft, dark mass.

The round or Irish potato is subject to several fungus diseases, two of which are termed blights. As one (*Macrosporium Solani* E. & M.), usually comes before the other, it is called Early Blight. This is recognized by the dark, irregular circular patches upon the foliage, and when left to itself under favoring conditions, will denude the vines and greatly shorten the crop.

The Bordeaux mixture, made by adding a solution of six pounds of copper sulphate in twenty-five gallons of water to four pounds of lime slaked and diluted in twenty-five gallons also of water. This bluish mixture may be applied to the potato vines by means of a spraying machine drawn by a horse or team and covering at least four rows at a time. The Bordeaux mixture can have the Paris green or London purple added and applied at the same time, thus checking the blight and the insects at one spraying.

The Late Blight (*Phytophthora infestans* D. By), is a very fatal disease when it has an opportunity to run its course. It first appears as a mildew upon the foliage and from there it passes down the succulent stems to the tubers, which soon decay. This is the cause of the famine-producing rot of historic interest in Ireland. Spraying will check this disease, but when the vines are badly attacked and the potatoes are nearly mature the crop should be harvested. Early varieties often escape the late blight.

There is a bacterial blight of potatoes of considerable severity. The affected tubers turn brown, become soft and melt down into an offensive mass of rottenness. Great care needs to be exercised in

selecting healthy seed and successive crops should not be attempted upon affected soil.

The leading trouble with potatoes in many localities is the Scab, produced by a fungus *Oospora Scabies* Thax. It attacks the tubers while they are quite young, and will continue to grow so long as moisture is upon the surface of the potato. The scab is quickly recognized by the rough coat of the tuber which is broken by ill defined spots and pits, and when first removed from the soil the injured parts are covered with a fine lead-colored mould. This fungus remains over from one season to another in the soil and is communicated to new potatoes from scabby seed. This suggests that only potatoes free from the disease should be used for seed, and if there is doubt the potatoes before being cut may be soaked for two hours in a solution of corrosive sublimate to eight gallons of water. When the soil contains the germs, which is usually the case, flowers of sulphur may be added in the open row at the rate of three hundred pounds per acre.

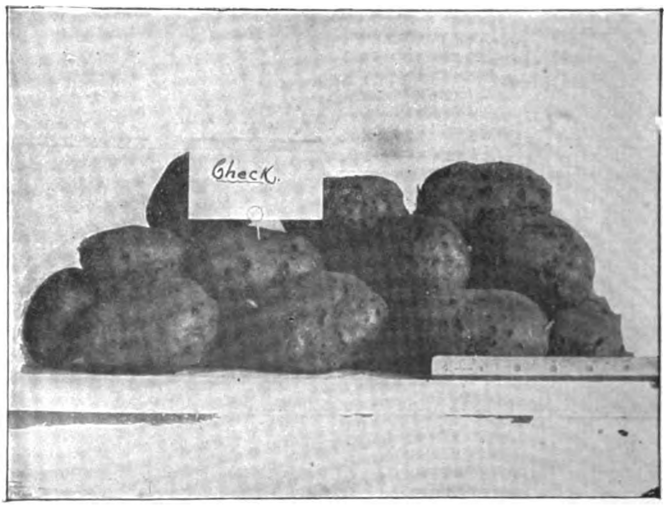


Fig. 2. A Pile of Scabby Potatoes.

Figure 2 shows a group of scabby potatoes taken from a field where no treatment had been applied.

The Scab of the beet is due to the same fungus as that causing the potato scab, and is becoming common in some localities. Upon the beets the affected parts are quite unlike those of the potato, and when the beet is a long one there is a well marked zone where the scab is located beginning about two inches below the surface.

There could scarcely be any seed treatment in case of the beets, but sulphur added to the soil may be of value. The leading fact to

make use of is that such distantly related plants as potatoes and beets are attacked by the same fungus and consequently these crops should not succeed each other when the scab prevails in either.

This is a fungus that is easily controlled by spraying.

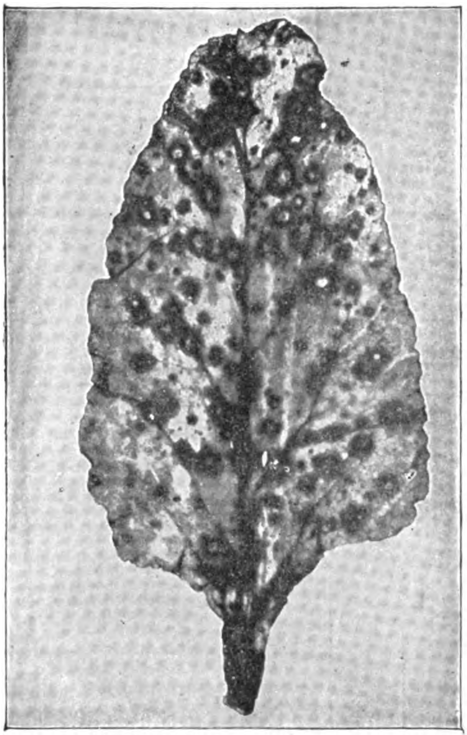


Fig. 3. Small Beet Leaf—Showing the Leaf Spot.

There is a leaf blight of the beet that has become very serious in many places. This is due to the fungus *Cercospora beticola* Sacc., and is quickly recognized by the many spots upon, followed by holes that it makes in, the leaves. Figure 3 shows a badly blighted beet leaf made from a sun print and shows everything of natural size. This is a fungus trouble of the ordinary sort, closely related to a blight of the celery and consists of threads that starting from the surface grow through the tissue and coming to the surface again produce a new crop of spores.

Fungous Foes in the Orchard.

If the fungi injurious to orchard fruits are considered, one of the first, from its conspicuousness, is the apple rust, due to the inroads of a fungus with a very long name, *Gymnosporangium macrpuso* L.. In general appearance a rusty orchard is easily recognized by the orange color which sometimes is seen from miles away. The rust appears in spots upon the leaves and stems, even the fruit sometimes being attacked. The orange spots produce a cluster of long, deep cups in which the spores are produced.

There is an interesting double life in the existence of this fungus, it thriving upon two widely different plants during the year. The spores produced in the cups in the apple leaf in summer pass to the cedar trees when they develop small chocolate-colored galls that remain until the next spring, when they enlarge very much, produce orange colored gelatinous horns with multitudes of spores that are carried to the apple trees, and then cause the rust.

Sometimes when a cedar tree is standing near an orchard it can be seen to be the centre of infection, and occasionally the rust is almost entirely upon the lea side of the cedar tree when the prevailing winds blow in one direction.

The remedy is, first of all, to remove the cedar trees and the next best is to pick and burn the galls from the cedars in winter or early spring and burn them. Spraying the orchard with a standard fungicide may prove effective, but as yet but few experiments have been made.

The apple scab (*Fusicladium dendriticum* Fcl.), is a fungus that attacks both the foliage and fruit, producing irregular patches upon the former that turn from light green to brown and become raised upon the underside. Upon the fruit the spots are more regular and usually possess a light gray border. If the attack is made when the fruit is small it causes a dwarfing of the specimen that may develop upon one side only, and become distorted, cracked and worthless.

This fungus is not a deep feeder, but growing just below the skin, and breaking it, develops the innumerable spores which germinate quickly and spread the trouble with rapidity.

Spraying can be resorted to with profitable results and should begin before the blossoms open, followed by at least three intervals of two or three weeks after the petals fall. Bordeaux has been used for the apple scab with excellent results.

The Fire Blight of the apple, pear and quince is a very destructive enemy in the orchard. It is easily recognized by the sudden wilting of the foliage in midsummer, its turning brown and the dying of the twigs as if scorched by a fire.

This blight is due to a micro-organism that winters over in the twigs and the individual germs escaping with the gum oozing from a diseased spot may spread to a tender opening bud, or is carried to a blossom by a bee and a new seat of infection is thereby established. In the apple it is not unusual to find nearly all the flower-clusters blighted and the leaf-bearing twigs may escape in large part.

In the pear the blight runs down the stems more rapidly than in the apple from leaf buds at their extremity. No variety is exempt from this disease, but some, as the Bartletts, are more susceptible than others. The Keiffer, once thought to be free from the trouble, is in later years showing much of the blight.

There is a "body blight" that causes dead patches in the main stems which is due to the micro-organism above mentioned.

The treatment of most value is severe pruning of the blighted portions whenever met with in the orchard, and burning the brush thus secured. The germs are very small and numerous and spraying has not proved effective.

There is a Leaf Blight of the pear that causes the affected tree to lose its foliage and stand leafless for months in autumn. This fungus, *Entomosporium maculatum* Lev., first causes discolored spots upon the foliage which enlarge and results in defoliation of the tree. The fruit is also attacked and remains small, becoming distorted and frequently cracked.

This trouble is easily controlled by fungicides and pear growers are using cart sprayers in the orchards with good results. While Bordeaux may be used for the early sprayings, a clear liquid as cupram is better when the fruit is reaching maturity.

The Black Knot of the plum and cherry is caused by one of the most conspicuous and destructive of the fungi of the orchard, and its presence is easily recognized by the large, rough, nearly black excrescences produced upon the branches. The fungus (*Plowrightia morbosa*, Sacc.), makes its attack upon the surface of the young twigs and the small knots there formed grow for several years or until the branch may be ruined.

This fungus produces its spores upon the surface of the young knots and also a second form within the substance of old ones, so that there is a chance of destroying it by spraying in the first case, but not less so in the second. The experiments thus far made indicate that the best treatment is the removal of the knots with knife or saw and burning them. Often the same kind of knots are produced upon wild cherry and plum trees and these need to be destroyed before the related orchard trees may be free from inoculation that may come from the forest or hedge row.

There is another fungus (*Exoascus pruni* Fl.), that is closely related to the one producing the black knot that causes the young plums to become much enlarged, soft and frequently hollow; stems and leaves may also be distorted with the same enemy. The treatment is similar to that recommended for the black knot. In cutting, the knife should, in all instances, pass several inches below the least sign of the knot or else the disease will continue to grow and form a knot upon the stub.

Under cherries the leading fungous enemy is the Brown Rot, caused by the *Monilia fructigena* Pers., which preys chiefly upon the fruit and, as its common name indicates, causes the affected part to become coated with a gray powder, the spores of the fungus. This is the most rapid growing of all the fungi injurious to farm and orchard crops, clothing in a day, if it be moist and hot, the surface of maturing fruit with the ashy substance. The growth is so rapid that when the conditions of moist atmosphere and ripe fruit obtain it is almost impossible to check it. However, good results have resulted from thorough sprayings of a fungicide.

The same fungus thrives upon both the plum and the peach, and

upon the latter the fruit dries down and mummifies upon the stem and the fungus frequently spreads from the fruit to the branch bearing it, and the leaves turn brown and die. In such cases it is best to remove the dead branches to the burn heap or else the fungus will spread far down the stems.

The leading fungus disease of the peach, other than those already described under cherry and plum, is the Leaf Curl, due to *Exoascus deformans* Fl. This fungus causes the foliage to become discolored, red or yellow, and puckered out of the natural shape. Sometimes only a single branch will bear the curled foliage and such should be removed. When confined to a few trees the trouble can be controlled with the pruning knife.

The Black Spot (*Cladosporium carpophyllum* Thum.) is a serious fungus upon the fruit, causing it to become spotted and dwarfed, followed by cracks and decay. It is likely that spraying would check this enemy, but the peach foliage is among the most sensitive of all plants and fungicides need to be used upon it with great caution.

The last enemy of the peach to be here mentioned, and by no means the least, is the "Yellows." It is recognized by the premature ripening of the fruit, which takes on an unnatural spotting of red and purple, streaked with the same color through the flesh from skin to pit, and a bitter or insipid taste. Tufts of small branches are produced upon the stems similar to "water sprouts" in fruit trees generally, but with slender yellow leaves of small size.

Fungous Foes of Small Fruit.

The farmer experiences the destructive effects of fungi upon his grape vines. They may attack the foliage causing frosty patches, as the downy mildew (*Peronospora viticola* D. By.) The berries, when attacked while still small and green, turn brown and are ruined.

There is a powdery mildew (*Uncinula Spiralis* B. & C.) that thrives in the vineyard and is particularly disastrous to the grape industry in Europe.

The Black Rot (*Laestadia Bidwellii* V. & R.), is the leading fungus enemy of the grape and attacks the leaves, young canes and fruit, causing spots in the first and a black decay in the last, with fine pimples over the surface of the shrivelled fruit. Dark sunken spots are produced upon the canes, and in its worst form the whole vine is ruined.

These troubles may be kept down by spraying with Bordeaux or later in the season, when the berries near maturity, a clear fungicide

may be used to avoid the lime of the Bordeaux as an objectionable coating to the fruit.

Among blackberries and raspberries the most destructive fungus foe is the Rust (*Puccinia Peekiana* Howe). This is readily detected in the upright position of the affected canes and the shiny leaves which later become orange-colored upon the under side from the exposure of the vast multitude of the spores. This fungus, like nearly all of its large class is very deeply seated and fills the whole plant with its threads before showing itself in the conspicuous spore-bearing condition. It follows, therefore, that spraying has not proved effective, and the best recommendation is the knife and the burn heap.

There is an anthracnose (*Gloeosporium venetum* Speg.), at times that attacks the canes and greatly shortens the crop. Good results have followed the winter treatment of the canes with copper sulphate and summer spraying with Bordeaux.

Currants and gooseberries are troubled by a leaf spot (*Septoria ribis* Desm.) and anthracnose (*Gloeosporium ribis* M. & D.), both recognized by the dark spots upon the foliage, followed by a dropping of the leaves. The treatment is the same as for the last fungus mentioned.

The gooseberry is particularly susceptible to mildew, and it has rendered the growing of European sorts precarious with use. This mildew forms a thick felt upon the tips of canes, including the leaves, and also upon the fruit. Sulphide of potassium, a half ounce to a gallon of water, has been used as a remedy for this trouble with marked success.

The strawberry has its share of fungous enemies, but none are more common than the leaf spot, sometimes called strawberry blight (*Sphaerella fragariae* Sacc.), which are known to nearly all by the round, ashy spots with purple border seen upon the foliage. Many remedies have been used, but removing the old leaves and burning them after harvest is quite effective. This will give the new, fresh foliage a chance to form and do its work. A frequent change of place of the bed is a good precautionary measure.

Fungous Foes of Vegetable Fruits.

The vegetable fruits have many fungus enemies, as for example, the bean with its Anthracnose (*Colletotrichum lagenarium* Pass). This shows itself early in the growth of the plant upon the foliage as narrow often purplish lines along the main veins, and later attacks the pods, producing the pits called the "pod spot." Figure 4 shows three badly spotted beanpods from the golden wax variety. This is one of the fungi that is easily controlled by spraying.

A second leaf and pod disease of the bean is the Bacteriosis, due to a micro-organism that produces watery areas in the foliage that soon dry up and break away. Upon the pods it forms water logged spots that become ulcers when the fruit is worthless. The conditions of the weather seem to influence the development of the bactriosis, a moist, warm spell being favorable to it.

The lima beans suffer from a genuine mildew that coats the pods with a white covering and ruins the crop. This is comparatively new and as yet but little in the way of remedial experiments have been made.

Peas are much troubled by a blight upon the leaves and fruit, blotching both and shortening the crop. This is due to a fungus (*Ascochyta pisi* Lev.) that is not easily controlled by fungicides. The late peas are usually attacked by a mildew (*Erpsiphe Martii* Lev.) and is so common that only early peas are usually grown on account of it. Bordeaux sprayings may be applied with success for the mildew.

Fig. 4. Wax Beans badly attacked by Anthracnose.

Tomatoes have a number of fungus diseases, but the leading one of late years is the Leaf Spot due to the *Septoria Lycopersici* Speg., recognized by the numerous small circular spots upon leaves and stems, followed by a loss of foliage and the ruin of the crop. The general appearance of a diseased leaf is shown in figure 5. This fungus begins its destructive work in the bed before the plants are set in the field and the remedy should be first applied, then growers of plants should cleanse their beds or make new ones, and if set in a new place it will be an advantage.

There is a blight of the foliage, due to *Clasosporium fulvum* Cke., which produces olive brown velvety patches upon the foliage. It is more common than any other fungous enemy to the tomatoes grown under glass.

There is a black rot, due to *Mcarosporium tomato* Cke., that works at the blossom end of the fruit and produces black spots, followed by cracking and a soft rot.

Bacterioses of tomato plants is due to a micro-organism that causes a wilting of the foliage and watery stripes upon the stem. The same bacterium produces a similar condition in potatoes and egg plants, and as the germs may be stored in the soil, these crops, if infected, should not succeed each other. A judicious rotation of crops is a cleansing factor in farm and garden economy.

Fig. 5. Tomato Leaf—Showing Leaf Spot.

Egg plants are more troubled from the Leaf Spot fungus (*Phyllosticta hortorum* Speg.), than any other. It produces large, irregular, brown patches in the leaves and similar blotches in the maturing fruit, causing the latter to decay with much more rapidity. Plants that are badly diseased rarely produce fruit and may perish in the seed bed when the fungus attacks the plants, and causes a destructive "damping off."

Melons and cucumbers are troubled with two fungi that often destroy the crop, namely, the mildew (*Plasmopara Cubensis* B. & C.), and the anthracnose (*Colletotrichum laginarium* Pass.). The former produces yellow patches in the leaves, and the latter forms ulcers in the fruit. Figure 6 shows a cucumber that before fully grown had been ruined by the anthracnose.

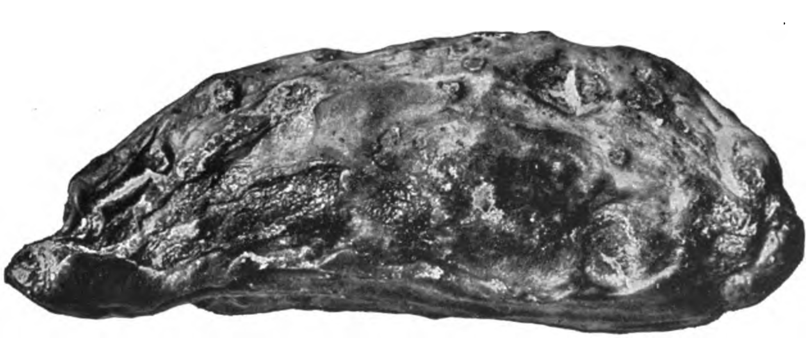


Fig. 6.—A Cucumber destroyed by Anthracnose.

Fungus Foes to Vegetables.

Celery has a number of fungus enemies, the leading of which is the blight or "Rust," so-called, (*Cercospora Apii* Fr.), known by the light brown spots produced upon the foliage, which may coil up and turn gray with the spores of the fungus. Bordeaux is easily applied and quite effective. Shading the plants seems to favor the crop and not the fungus.

There is a bacteriosis that attacks the celery usually after it is stored and destroys the tender heart of the plant. No remedy has been devised for this and care needs to be taken to keep the plants from excess of warmth and moisture while stored.

Spinach has two leading fungi; the mildew (*Peronospora effusa* Raben), and the anthracnose (*Colletotrichum spinacaciae* E. & Hals), the former producing violet velvety patches upon the foliage and the latter brown circular blotches.

Only clear fungicides would answer upon the spinach, as anything like the Bordeaux mixture would soil the looks of the plants for market.

Onions have as their chief fungous enemy the smut (*Urocystis Cepulae* Fr.), easily detected by the blackish masses of spores produced in the bulbs and foliage above. When the soil becomes infested with the spores a mixture of equal parts of sulphur and lime sprinkled in the row at the rate of three or four hundred pounds per acre is found effective. Better still, land that is known to be smutty should be given to some other crop and only returned to onions after several years.

Asparagus has a new and serious rust preying upon it. This fungus (*Puccinia Asparagi* D. C.), is recognized by the premature browning of the brush, the stems being blistered and showing numerous spots of a reddish or dark brown color.

While spraying has given some favorable results it is best to cut and burn the rusted plants so soon as they become at all brown in appearance.

It has been the purpose of this paper to briefly describe the worst fungous disease of the farmer's crops and give methods that have been successful in checking them. As far as possible the fungi have been considered in the order of their importance with each crop, beginning with those of the field and ending with those of the garden.

RIGHTS OF FARM EMPLOYER AND FARM EMPLOYE.

By HON. GEORGE W. HOOD. *Indiana. Pa.*

It is not necessary that every farmer, or farm employe, should be a lawyer, but there are certain fundamental principles of law, founded upon reason, common sense and the decisions of our higher courts, which should be known by every man, no matter in what business or employment he may be engaged.

Therefore, in the presentation of the subject at hand, we shall take as our polar star these well defined and long settled principles of law, equity and justice, which have come down to us through the ages, and from them, deduce the individual and mutual rights of all parties interested.

When a farmer hires a man to work upon his farm or perform any kind of labor for him, along with the contract of hiring goes the obligation to pay in some way or other for the labor performed.

If, however, a laborer has been hired for a specific time, whether at so much per month, week or day, he cannot break the bargain for a mere whim and make his employer pay. If this could be done, the laborer might leave the farmer when he was harvesting his crop, threshing his grain, or engaged at something when the damage he would sustain by reason of his inability to hire other help, would far exceed the amount of wages due. The principle of the law is founded upon the doctrine that the laborer has made a specific, fixed, entire contract, and that the employe must fulfill it or be entitled to no pay. Any other construction of the law would be greatly detrimental to the employer, whilst on the other hand the employe would be well informed that the only safe course for him to pursue to receive the commendation of his employer, and his pay according to the previous contract, would be to carry out; to the fullest extent the original bargain.

As an example, if a laborer agrees to work for six months, a year or two years, as the case may be, he must comply fully with his contract. Whether to build fences, dig ditches, build a house or barn or whatever he would be engaged to do, if his contract was for a specific sum, he cannot compel his employer to pay him anything unless he fully complies with his contract.

Of course, this principle must be understood as not to be enforced with precise strictness under all conditions. If the laborer substantially complied with his contract, and in good faith carried it out to the best of his ability, he would in justice be entitled to his pay.

The principle of law applies to those cases where the laborer wilfully and without cause abandons his employer, and fails to perform his part of the contract.

On the other hand, it is not every person that is competent in law to make a contract. Persons under twenty-one years of age cannot be held to the performance of their contract; and yet the farmer making the contract with the minor, if the minor performs his part of the agreement, cannot escape from carrying out his part of the arrangement. The distinction is that one is competent in law to make an agreement whilst the other is not.

In employing hands the farmer takes the risks even though he is deceived by the young man's appearance, or even if he falsely stated that he was over twenty-one years of age he cannot then avoid his part of the contract. Thus saith the law and its maxim is "Ignorantia Legis neminem excisat,"—"Ignorance of the law excuses no one."

If the laborer gets sick, or is in any way physically disabled, whereby he cannot work, he would be justified in leaving and recovering pay for the time he had worked. If some dangerous epidemic should break out in the community or in the family, such as small-pox, cholera or the like, he would be justified in leaving and recovering pay for the time he had worked. If he is not properly treated and cared for, if he is fed improper and unwholesome food, if he is furnished an unhealthy and disagreeable place to sleep; in short, if he is not treated by his employer as an intelligent human being, he would be justified in leaving and could recover pay for all the time he had worked. If he was arrested and imprisoned for the commission of any crime, it would be a sufficient legal excuse for leaving the farm and recovering all back pay due him. Mere harsh language, however, by his employer, or minor disagreements as to how the work should be done, or the days on which he should work, or occasional disparity of temper on the part of either, would not be sufficient grounds for leaving, even though disagreeable and annoying to both employer and employe. The law recognizes *only* as reasons for the non-performance of a contract, fairly and understandingly entered into, those which are real, substantial, just and right and which are sanctioned by the reason and good judgment of intelligent men.

The farm employe is required to do such work as is ordinary and customary to be done on a farm. Such as plowing, harvesting, clearing land, building fence and general farm work. If he were employed by the month his duty would be to assist his employer to do such farm work as was necessary to be done on the Sabbath day, such as feeding and watering the stock, taking cows to and from pasture, laying up a few rails of fence blown down by a storm the night before, if necessary to protect the growing crops. The farmer is also required to furnish his employe with suitable tools to do particular work desired,

and failing in this he alone would be to blame if the work was not properly done.

Instances might be quoted in which a farmer may be justified in discharging his employe at any time, and for which the hired man could have no redress.

If he were in the habit of getting drunk, or creating disturbances among his domestics or members of his family; if he were in the habit of coming late to dinner, and paid no attention to the ringing of the dinner bell; if he was guilty of gross moral misconduct; if he goes off fishing and hunting when he ought to be plowing, harvesting or hoeing corn; if he wilfully disobey the commands of his employer, and habitually neglects to do the work required by him, he would be justified, when any of these conditions clearly and manifestly appeared, to immediately discharge him, and he could have no redress in law for damages.

The books containing the reported cases taken to our highest courts are full of decisions sustaining this principle, and it would be well for both the farmer and the laborer to conform their course very nearly in accordance with the well established principles of law laid down by our courts, because to them both it may prove the means of saving them many a long and tedious lawsuit.

The farmer, accustomed to the hiring of hands, is often called upon to make redress for injuries done by his hired help, and to settle the perplexing question as to the extent of his liability, he may have been compelled to consult his lawyer and from him obtain the necessary instructions as to what he should do.

As a general principle, it may be said that the farmer is liable for all the injury his hands may do whilst in his employ. If he sends his team to town with a load of grain or vegetables for the market, and his driver carelessly runs into another team, and breaks his wagon, injures his horses or does damage in any way, the farmer is liable for the damages he may cause.

If he sends his hired man to mill and he meets a loaded wagon by the way and does not turn out and give one-half of the road, and his wagon or his horses are injured in any way thereby, he is liable for the damage his driver may have caused.

If the laborer whilst clearing the farmer's land, sets fire to the brush upon his clearing and the fire breaks over into his neighbor's fields and consumes his crop, burns his buildings or in any way damages his property, the farmer would be liable to the extent of the damage done. It matters not how often the farmer has cautioned his hired man, or from what cause he had permitted the fire to escape, as between the farmer who hired the man and the neighbor who received the injury, the farmer would in every sense be liable to the latter for all the damages done.

It has been held, however, in the case of Knight against Luce, 116, Massachusetts State Reports, page 586, where it appeared that a person was employed to clear land adjoining a road. He cleared a little outside the stone fence and burned in the road. Plaintiff's horse got frightened and ran away and the plaintiff was thrown from the wagon and hurt. For his injuries he sued the owner of the land, who defended on the ground that the employment was to "clear up the land within the lot" and not the road. The jury returned a verdict in favor of the defendant, which on appeal was affirmed. This case settled the doctrine, that where a person was employed to burn brush on the land of another, he had no authority to burn within the limit of the highway adjoining, though the public had the right of way over the land and the farmer had an estate to the middle of the road.

So in Wilson against Peverly 2, New Hampshire, 548, where a laborer was employed to harrow in one field and watch a fire in another, he undertook to do more and set fire to a pile of rubbish, and from this last fire escaped and burned plaintiff's property.

In an action for damages against the owner of the land he was held harmless, the court giving the rule: "When a laborer acts under the special order of his employer, the employer is not liable for his negligence in doing business not ordered."

These decisions, however, do not controvert the principle that the laborer is liable to the suit of his employer when a third person had brought his suit and recovered damages against his employer for injuries sustained in consequence of the laborer's negligence or misconduct. The liability of the laborer thus employed exists under all conditions and circumstances, and the only way for the employe to be relieved from his liability, is for him under all conditions to perform such labor as is assigned him by his employer in a spirit of carefulness and consideration of his employer's rights. Another question arises, as to how far the farmer is liable on his employes' contracts, made in the usual course of the employment by the farmer, for and in the name of his employer.

Where a laborer is employed for the general conduct of a business by the farmer, and has no particular orders as to how the business is to be transacted, he is considered invested with all the authority necessary for properly conducting it.

The law presumes sufficient power delegated to the employe by his employer, to ordinarily perform the work necessary to be done to carry on the business in the usual and ordinary way, though he would not be bound by his contracts at the mill without the authority of his employer, because if he were given free license in this direction, there might be no end to his binding his employer.

So also would the farmer be liable for his hired man if he carelessly drove his mowing or reaping machine along the public road from one field to another, or from one farm to another and did injury

to his neighbor's cattle, horses, sheep or hogs, by maiming or injuring them in any way. In many of the states it has been held by the highest courts that even if the employer showed maliciousness in his act, done in the prosecution of his employer's business, and intentionally ran into another team which obstructed the road when he was driving along the highway with his load, that the farmer could not shelter himself behind him, and plead unnecessary and willful violation of his orders. This is the law when the hired man has gone on business for his employer, but it is otherwise if he take an "occasional" day off, borrows his employer's buggy and goes on a pleasure excursion. 'Tis then the hired man rises to the same level as his master, and is his own master, and consequently responsible in his own right and person for damages he may do. The same principle would apply, if the hired man took the farmer's team without his knowledge or consent and went off on a trip of pleasure or business of his own.

As to the hired man's liability to his employer for injuries or damages done to the public, if it was the result of carelessness or malice, the farmer would have his remedy against his employe. If it was not done through malice or carelessness, and was brought about by the farmer's vicious or unruly horses, which would not keep the road or turn out in passing as required by law and were not under the control of the driver, the fault would be with the farmer and he could not collect damages off his driver.

But whilst the employer is responsible for any careless injury his men may do to third parties, he is *not* responsible for injury to other workmen. If farm hands get into a "row" among themselves and some of them get hurt, the farmer is in no way responsible. When men hire in any business, whether to a farmer, or whoever it may be, they take upon themselves the risk of being hurt or injured by their fellow workmen, and it would be unjust to the employer to hold him responsible for acts committed among themselves, and against one another. Yet on the other hand, it is fair and right, especially to the public, that the farmer should be held responsible for the acts or negligence of his employes, because he has a remedy against them which the public has not. If the farmer furnish dangerous or insufficient machinery for his employe, or hires notoriously incompetent men and the public suffer thereby, there could be no other remedy than to hold the employer responsible in such cases.

The law of our State is, that when one party, the farmer or the hired man, refuses to perform his part of the contract, he puts it into the power of the other party to either sue for the breach of it, or to treat the contract as rescinded or abandoned and sue for the work actually done.

Contracts fairly and understandingly entered into between farmer and hired man are like all other civil contracts, binding upon each

party, for their strict performance, in default of which either would be liable to the other.

If both contracting parties use the same good judgment in entering into a contract for a term of months or years, as men ordinarily do in entering into other business engagements, misunderstandings would be few, and lawsuits fewer and general good feeling would prevail, and the mutual advancements of each interest would be so marked, and assured, that the causes for any fault or hard feeling would be absorbed or lost in their general prosperity.

We are often asked the question as to what rights exist between employer and employe as to working on legal holidays. In a word, the question may be answered, that to one familiar with the law, it would seem that holidays had been provided for almost every man but the laborer. Among the varied business employments there are many which can know no holiday, not even an occasional Sunday, and hence from one year's end to another, oftentimes the laboring man goes the usual round every twenty-four hours, not enjoying that breathing spell from business accorded to the banker, the merchant or the clerk.

In factories, furnaces, iron mills and large manufacturing establishments, oftentimes, men are required to be at their post at regular fixed hours during each twenty-four, and were they to appeal to their employer to let them off for a day, and he was unwilling to do it, they could have no redress, and if they left on their own accord and thus broke or violated their contract, their employer would be justified in discharging them, and that, too, without remedy. Thus as to secular or unnecessary business affairs, no holidays are known. but each is left to do that which most suits his convenience and pleasure.

The act of the General Assembly of Pennsylvania, approved April 14, 1868, P. L. 99, provided that "eight hours of labor between the rising and the setting of the sun should be deemed and held to be a legal day's work, in all cases of labor and service by the day, where there is no contract or agreement to the contrary, except ten hours a day shall be a legal day's work in factories for all persons, and employes under twenty-one years shall not be employed *more* than ten hours." But it also provided in the same act "that it shall not apply to or in any way affect farm or agricultural labor, or service by the year, month or week. Nor shall any person be prevented by anything contained in said act, from working as many hours over time or extra work as he or she may see fit; the compensation to be agreed upon between the employer and the employe."

This act of the Legislature is plain and quite easily understood, and whilst the law in the absence of any agreement to the contrary fixes the number of hours constituting a day's work, yet it leaves it in the power of the employer and the employe, by special bargain or con-

tract, to fix any other hours or number of hours constituting a day's labor, the policy of the law being to leave all matters possible to the intelligent judgment of the employe or employer, which is certainly in accordance with the American idea of doing things.

The act of the Legislature of April 9, 1872, relating to wages of laborers, mechanics, miners, etc., does not apply to farm hands. The intention of that act was to furnish a more speedy remedy to the miner or laborer employed about the mines, manufacturing establishments and the like, in the collection of their wages, and provided that under certain conditions their wages should be preferred and first paid out of the proceeds of sale of such manufactory or mine.

Great benefit has in large numbers of instances in Pennsylvania resulted to laboring men by taking advantage of this act. Large corporations employing great numbers of men have learned to regard this act, in its full extent and meaning, and the courts of the Commonwealth have in all instances enforced it to the great benefit of the employe and with no detriment to the employer. Had the same act been extended to laborers of all classes, it might have been well, but it was thought wise by our legislators, and the distinction has been carried out by our courts, to hold more sacred the rights of him who worked in the mine and in the factory, and throw around him a guarantee that his earnings should be secure to him and his family, than the man who works upon the farm, with the usual and ordinary assurance that his wages, too, would be secure to him, but in a somewhat different way. The risk of the miner and the laborer at the factory are greater than the laborer upon the farm, and in proportion as the risk of the one exceeds the other, in that same proportion the legislative mind has been directed to afford protection to the earnings of him who takes the greater risk to life and health, and to guarantee his earnings to himself and to his family.

The farm laborer, however, is not left without some protection, as a review of the acts of our Legislature and decisions of our courts will clearly show.

Under the act of 1849, wages of all laborers are preferred to the extent of fifty ($50) dollars, out of the proceeds of sale of the personal property of the employer. Oftentimes employers become involved and their properties are forced to sale and under the provisions of legislative enactments, their employes are protected to a certain extent, which, oftentimes, proves of great value to the laborer.

The rights of miners, laborers and mechanics under the legislation of our State and as construed by our higher courts, cannot be fully set forth in all their details in an article like this, but sufficient can be given to show the general legislation on the subject of the decisions of our courts, which in the opinion of the writer, have been judiciously given, and where a doubt has arisen as to the construction of

the law as between the employer and the employe, it has been in favor of the farmer rather than in favor of the latter.

Laboring men of all classes in our State, believing that their interests would be advanced, have formed organizations for their protection, and whilst much good may have been done, and perhaps some just and equitable legislation obtained through organized labor, yet the laboring man must look to the law itself for his protection. Organizations may educate the people and assist to mould public sentiment in favor of labor, but in the Legislature and before the court, must all alike appear for the enactment and enforcement of such law as will do equal justice to the employer and employe. Legislatures and judges of courts are but human, and appeals made to them, as a general rule, are considered and adjudicated as any other matters are considered and adjudged, and if the honest, intelligent laboring man would use the same cautious judgment and intelligent sense in trying to impress his rights upon the lawmaker and the law interpreter that he exercises in other matters, he would oftener succeed better than he does.

Matters of detail, in relation to laborers' rights under the various special acts of the Legislature, such as giving legal notice to the proper officer, and statement of amount claimed, etc., should be entrusted to the consideration and care of some one who knows, at least the forms of law to be complied with, and in this matter the laborer would do well to consult his lawyer and entrust the enforcement of his claim to him. Large corporations and great manufacturing establishments when pressed for the payment of their obligations, look out for themselves, and unless the laboring man has some one to represent him before the court, and see that his rights are maintained, he will in many instances fail in recovering what justly belongs to him. Whilst this condition of things is the exception and not the rule, only occurring during times of business depressions, or great inactivity in the markets, yet history and experience teach us that they do come, and it is wise to be on guard and prepared for the emergency when it does come.

To sum up in a general way, the laborer is bound to render service under his contract, and the farmer is bound to pay the stipulated price therefor.

The presumption of law is, and his contract implies, that the laborer is possessed of sufficient skill and information to perform the labor required by his employer. He is also bound to give diligence and attention to the duties of his service, and habitual neglect or absence, occasioning loss or injury to his employer, will justify a dismissal. although it be neither wilful nor designed.

The contract of the laborer is to obey all proper and reasonable commands in the line of his employment given to him by his em-

ployer; if, therefore, such a command be disobeyed or wilfully neglected, he puts it in the power of his employer to break off the contract, for which he may be discharged or held liable for damages, or both.

On the other hand, the command must be reasonable and just and within the fair scope of the employment, and where there is personal risk or danger to himself, if he may reasonably decline to take the risk of personal injury without liability of financial responsibility.

It is also the duty of the farmer, not only to provide for his employe the necessary food and sleeping apartment to keep him in good health, but he is to look to his safety as well; to protect him from accidents by such means as an ordinarily prudent man would avail himself for his own purposes; to furnish him with animals and machinery properly to carry on his work with reasonable safety to his person.

But it cannot be expected that the farmer is an insurer or guarantor of the life or health of his employe, much less to covenant to guard him against all accidents, the contract being on the hypothesis that the employe is a rational creature capable of judging and acting with reference to his own safety; but where both parties, the employer or the employe, were cognizant of the risk before entering upon the performance of the work, the laborer could not recover from the farmer for any damages he might sustain.

The farmer may regulate the time for the commencement and quitting work, due regard being had to the customary hours for labor and season of the year, and the laborer is not to be the judge of when he may be required. His contract is to give his time absolutely to his employer, and hence he may not assume to absent himself from his employer's premises, or go without leave of absence, except under extraordinary circumstances, but he is bound for the full term agreed upon.

By misconduct he warrants his discharge at any time, without payment, and the only safe course for him to pursue is to carry out his contract with his employer to the best of his skill, judgment and ability. He is not to be enticed away or persuaded by some interfering or designing person to not perform his contract, but he is to go straight forward, complying with his contract in every possible particular to the extent of his ability.

If by negligence, or wilful misconduct, he has caused his employer to pay damages to a third party, he is liable to reimburse him for all damages he may have caused, and the measure of the damages he would be entitled to pay would naturally be the amount of the judgment which his employer had been compelled to pay to satisfy, together with all costs, including counsel fees.

Hence, the importance to both employer and employe, to carry out to the fullest extent, with an honest and sincere purpose, the terms

of their contract, and thus avoid all possible chances of disagreements, which prove of no advantage to either party, but a source of discomfort and annoyance to both.

THE BED CULTURE OF MUSHROOMS.

By PROF. CH. REPIN, *Associate of the Pasteur Institute, Paris.*

(Translated from *The Revue Generale des Sciences*, for the Department of Agriculture, by SARAH D. MEEHAN LANNING, Philadelphia, Pa.)

On going through the suburbs of Paris, particularly the plains which extend to the south and southwest of the capital, one's attention is instantly attracted to the wooden constructions having the appearance of fair grounds, kinds of square towers which sparkle in the sunlight in the most unthought of places, in the middle of waste ground plots, cultivated fields, gardens, and even upon the glacis of fortifications. Sometimes a cloud of smoke hides their tops, still more exciting the curiosity of the passerby, who wonders from where the smoke can come.

In reality, these mysterious apparatuses are nothing more than chimneys, so to speak, destined to facilitate ventilation for the immense subterranean caves given over to mushroom culture; an industry little known, although of much value, because of its real economic importance. The value of its products just in the outskirts of Paris, amounts to several millions annually, which is sufficient reason for it to come under the notice of biologists, to say nothing of those interested in economic sciences. It is, in fact, at the present time, one of the great gaps in the path of vegetable biology, to be ignorant of the nutrition in the higher kinds of mushrooms, notably the entire order of Basidiomycetes and those of Discomycetes (a).

It is apparent that these vegetables without chlorophyl must, when they do nead an existence either parasitic or symbiotic, find the needful nutrition for their tissues in the destruction of certain organic combinations. But it is just here that obscurity arises. Not one of the hydro-carbonated nor azote matters used in the food of the Mucedineae and some other of the inferior mushrooms is assimilable by the kinds we speak of; consquntly we do not know how to cultivate, in the scientific use of the word, superior mushrooms.

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a. Basidiomycetes is that class of fungi embracing the mushrooms and toadstools. Discomycetes are the disc or cup-shaped forms.

GATHERING MUSHROOM CROPS. VIEW TAKEN IN PARIS, FRANCE. (MONTESSON) CAVE

It is true that Brefeld has obtained development on glass of *Coprinus stercorarins* from manure, and Hartig that of *Agaricus melleus* from the roots of plum trees. But these learned men have really scarcely done more than transport to the laboratory that practical empiricism which in Italy originates asthma from *Agaricus caudicinus* from the dead roots of the black poplar, or that of *Polyporus avellanus* from half burnt branches of nut trees. It would be particularly interesting to know why the special habitats belonging to mushrooms which we are going to name and reproduce in a purely artificial way should develop the chemical conditions of their normal development.

BRICKS OF MUSHROOM SPAWN.

It is the end to which I have been aiming for several years, in a series of experimental researches which have principally been on the Cave Mushroom.

Agaricus or rather *Psalliota campestris* (b), according to modern nomenclature, favors especially well a task of this kind, because of the facility with which it is generated on the manure heap, and the relative rapidity of its evolution.

The results which I have obtained, although incomplete, are, however, of an enlightening nature, and make several points easier in the work of other mushroom culturists, and that is why I publish them now.

First of all let us hurriedly show the technical parts of this culture.

I. PRESENT METHOD OF CULTURE.

With the Coprins, the field mushroom is the most fastidious of all good mushrooms as to the choice of its dwelling place. It manifests, however, a marked predilection for the half decomposed manure pile, consequently there is where it evidently originated.

We know that the culture of the cave mushroom had its birth in France in the second half of the last century. At first it was only an accessory branch of culture carried on by the kitchen gardener in the

b. The common mushroom.

spring and fall. At the beginning of this century a horticulturist by the name of Chambrey, thought of growing mushrooms in subterranean caves where the temperature and conditions were favorable for Cryptogams. Having thus succeeded in creating a very lucrative employment, he found numerous imitators who were quick to occupy all the abandoned quarries. Even at the present time the culture of the cave mushroom although carried on all over France and abroad, has its principal center in our subterranean caves.

Formerly these caves were distributed exclusively on the left shores of the river Seine, in the sections which extend from Meudon to Ivry on the Seine, comprising the territories of Vanves, Clamart, Chatillon, Montrouge, Bagneux, Arcueil and Gentilly.

From there it extended even to Paris, as far as Val de grace, where Parisians know the caves well by the name of Catacombs. At a more recent period other excavations were dug out not less vast under the plain which extends from Mt. Valerien to St. Germaine on Laye and Argenteuil, around Nanterre, Houilles, Carrieres Saint Denis, and Montesson. Less groups are Maisons Alfort, Romainville, Noisy le Sec. and Villetaneuse. Finally, as the means of transportation became greater, employment of caves took advantage of Paris, localizing itself in the Valley of Oise, near Meru and the environs of Creil.

The caves were dug in limestone regions, some in chalky territories as at Meudon, others in gypsum districts, as at Argenteuil. The oldest caves are scarcely more than a labyrinth of straight, low galleries, in which a man hardly has room to move about; but the more modern ones have greater proportions of height and spacious naves, supported by heavy pillars cut from limestone, which present quite a picturesque and magnificent view.

The conversion of a cave for mushroom culture is very simple. The mushroom grower assures himself of the ventilation if the caves are not already dug out, by making in a suitable place some chimneys, so to speak; he digs a well, an abundance of water being necessary for his business; then if the cave is too dry he covers the ground with a bed of limestone sand, powdered and beaten, to be used as a reservoir for humidity.

Let us now go out in the air to follow the manipulation of the soil which will give the highest culture. As near as possible to the mouth of the cave the grower must be able to procure manure in large quantities at a time, which explains why the occupation of cave mushroom culture can only be profitably carried on in proximity to villages.

The quality of the manure is an important item. The only kind suitable for the purpose is horse manure, and there is also a considerable difference in this manure in different provinces; the richer it is in droppings and urine the better. The manure from private stables is worthless, because it does not remain long enough under the

horses. That which is most sought after is from working horses, which are used to a large amount of muscular labor, thus receiving a very azotic element; the urine of the working horse is, in fact, more charged with urea and hippuric acid. Certain changes in the food of the animals will change the quality of the manure which sometimes proves disastrous for the mushroom grower; such is the case with horses that have been fed on carrots, and those that are subject to repeated purgatives, etc. I give all these details because we have to give, further on, explanations of them.

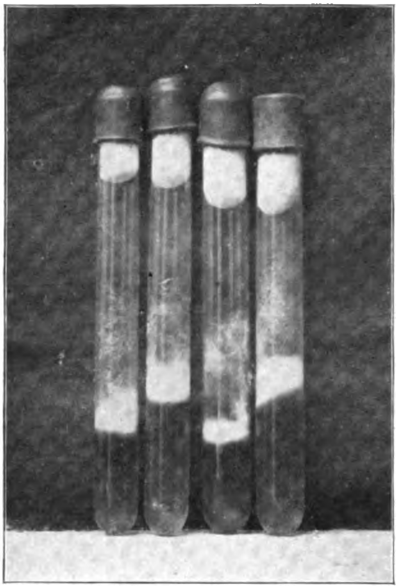
The manure is collected and laid with a fork in order to mix better the droppings, dry straw and urine; it is sprinkled and then methodically heaped up into great piles called *planchers* (d). The dimensions of planchers are variable. Some cover from 500 to 1,000 cubic metres (c). To obtain good results it is necessary to operate not less than a score of cubic metres, and growers scarcely ever have less than a hundred metres of "planchers." Only the height of the "planchers" is uniform: it is about 1m., 20. Under a less thickness the manure will not steam enough; under a greater the central parts of the mass will steam too rapidly, drying it up and arresting the fermentation. As soon as it is heaped up and jammed down it begins to ferment. The temperature in the center of the "plancher" rises in a few days to 80 and 90 centigrades (d). At the end of eight days the "plancher" it turned over, taking care to restore the water which has been lost by evaporation, and turn inside those portions which have been outside, so that they may in turn ferment. Three weeks are necessary and three successive turnings. It then presents a characteristic aspect. The straw by no means as black as that usual in manures, has taken a uniform fawn colored tint; each stem is distinct and intact: however, if it is examined more closely it is ascertained to have completely lost its stiffness; and if it is twisted a moment between the fingers it resolves itself into a number of fibers exactly as hemp or flax goes after retting. The odor of this manure is quite peculiar, resembling a little that of the cave mushroom itself. Up to this time it does not represent much more than half of its primitive volume, and it should hold just enough water that when pressed hard in the hand not a drop can be pressed out.

It is put into the cave where the workmen receive it and put it in mows. These mows are like prismatic borders, made straight as possible, strongly beaten down, and carefully raked, running without interruption the length of the galleries, or when the space permits, in straight lines side by side like furrows of a field. Experience has taught that these mows must be 40 centimetres in width at the base and the same in heighth. These dimensions allow the manure

c. The French metre is a little over a yard—about 3 feet 3¼ inches.

d. Plancher, as employed here, indicates little more than wide heaps.

to heat lightly and to attain a temperature of 15 degrees to 20 degrees without going beyond. The moment has then come for *storing* (e) it, that is to say, putting into the mows the portions of manure filled with mycelium or *mises* which answers to the same thing as cuttings or slips. The *mises* are arranged quincuncial on each side of the mows, completely embedded in the manure, which is pressed down lightly on top to make the contact more sure. Provided that the spawning has been done at the right time, that is at the moment when the manure was tepid and moist, the mycelium (spawn) in which the life is suspended, will not be long in starting into activity. It will put forth its filaments which will radiate in all directions, and finally overrun the whole mow, in time variably following the calorical and hygrometrical conditions which make each quarry as a particular climate.



MUSHROOM SPAWN GROWN FROM SPORES IN TUBES FOR BACTERIOLOGICAL CULTURE.

The control of these conditions, although facilitated by the depth of the quarries, preserves them from the sudden variations of the outside temperature, constituting the most delicate part of the grower's art. The difficulty comes above all from the enormous quantity of oxygen which the mushroom absorbs. In these respects these plants cannot be compared with animals; Wilson has stated, for instance, that a fresh pileus of *Lactarius piperatus* exhales in an hour and a half 59 milligrammes of carbonic acid. When the air is not sufficiently renovated with oxygen, mushrooms are stunted at once in the beginning of growth; they *sulk*, as growers say. Therefore the necessity of establishing good ventilation in the quarries. On the other hand it is also indispensable to the prosperity of the culture to maintain a hygrometric state of air approaching as near as possible the point of saturation and avoiding variations of temperature. In order to harmonize these opposite exigencies, the grower has scarcely any other means of action than the draught chimneys, so to speak, to which we have alluded; sometimes he regulates the draught by lighting a fire at the base of the chimney, at other times he moderates it by doors and dampers placed at different points in the galleries.

e. The centigrade thermometer starts zero, at our "freezing point," or 32 degrees, so that the figures here would indicate 110 degrees or 120 degrees of our thermometer.

The work is not sufficient in itself to make a capable mushroom grower; he must have born qualities, powers of observation, and ingenuity. Mycelium exposed in the cave will fructify poorly. In order to obtain an abundance of mushrooms it is indispensable to cover over the surface of the mow with a bed of limestone soil or sand.

This operation is called goptage. Goptage brings about a physiological element in the mycelium which is evidenced by the following experiment: In a large glass bowl heap successive layers of manure and earth for goptage, then a mise (piece of spawn) is placed in the last layer of manure. The mycelium will direct itself vertically towards the bottom of the bowl, and it is thus ascertained that it undergoes a complete change in character while traversing the manure in the earth under goptage. In the earth it has the appearance of a felting in which the tightly drawn threads form a very dense sheath around each blade of the straw. In the soil, on the contrary, it collects in heavy cylindrical cords, slightly branched, and these seem to suck out all the sap of the filaments, which soon wither; this phenomenon signifies that the mycelium goes to the center and is not nutritive enough in itself for fructification, following a very general law of cryptogamic biology; and that, following another rule none the less certain, the primitive protoplasm distributes itself in all changes of the vegetable tissue, and accumulates where the carpophores form. As soon as the mycelium filaments have penetrated the soil for goptage, they form into cords, and upon reaching the air expand into bouquets of little tubercles, each representing the outline of a mushroom.

The manner of goptaging the soil is purely natural philosophy, and it is delusive to add as some advise, nitrate of potash or any other mineral compost from which I am sure mushrooms cannot draw any part.

Mushroom threads lengthen during two to three months at least; but growth is not continuous, it proceeds by leaps, separated at intervals by non-production, during which, doubtless, the mycelium imbibes from the manure new nutritive elements.

In cultivated mushrooms may be distinguished a large number of varieties, which lead to two principal classes, a white kind and the other brownish. The other classes are named after the color of the cap. Pure white mushrooms are obtained from the markets only at high prices. The most important classification from a commercial point of view is that upon which one should be able to base the difference of weight, or more properly speaking, the thickness of mushrooms. Certain varieties have a slender jointed stem and spongy tissues, while others have a large and full stem and solid flesh. It is clear that these last will outweigh to the number and equal volume measurably more than the first. Now, since mushrooms are sold by weight, it can be seen that the benefit to the grower comes in to a great

extent from this merit in the cultivated variety. Unfortunately, the value depends also upon several other circumstances, for the harvest is always uncertain, and the cave mushroom is one of the most dependent on contingencies known. Laying aside the physiological difficulties which the mushroom grower, as I have said, must surmount nearly every day to maintain the proper atmosphere in the cave, I will not speak here of the causes of unsuccess relating to bad quality of the manure, of the particular physiology of the mycelium, and diseases of which the mushroom is no more exempt than any other cultivated plant.

CHAPTER II.—PREPARATION OF THE MANURE.

Two points dominate the whole question; first, the manure only acquires its nutritive properties by fermentation; second, this fermentation is different from the common fermentation of the confined manure; it is specific.

Fermentation is necessary because if fresh manure is used it is sterile, and when sown with Agaric spores in view of germinating, the plant at this stage, never accomplishes its complete evolution; it germinates, throws out mycelium filaments which may acquire a noticeable development, but it will not fructify. In a word, it behaves like a plantlet which lives in continued reserve in the seed without assimilating any new food. All higher class mushrooms of which I have been able to germinate the spores, possessed an apparent sterile mycelium which could live indefinitely only on condition of finding a humid substrata, and propagating itself only at a great distance from its starting point, the oldest parts withering as the head advanced; even several Ascomycetes, amongst them the Morell, may give under these conditions conidian (Botrytis) forms, which reproduce themselves afterwards on better foods and seem definitely fixed. These myceliums ought only to be considered as a provisory form of the plant, permitting it to seek for the food necessary in its normal condition; the conclusions which may be drawn from a study of this kind are not in any case applicable to corresponding fructiferous forms.

I shall pass over in silence experiments in which I have worked out separately each element existing in the manure even to a fraction, as the matters extracted from the straw, and the organic compounds of the urine of herbivorous animals. Neither will I recount the innumerable trials effected by other experimentors or by myself, with a view of establishing means by the aid of mineral salts or organic substances which are known to be assimilable by inferior mushrooms or microbes. The results have been invariably negative.

It is, I repeat, in complete and fermented manure that Agarics—the mushroom—finds favorable ground.

In fermenting, the manure is full of microbes; it becomes, using an expression of a tiller of the soil, *a living mass*. Now a preliminary question arises: should not the presence of these myriads of microbes be precisely the essential condition for the normal development of the Agaric?

Between one or the other of these microbian species which are liberated by the combustion of hydro-carbonated straw in so great an amount of energy, should there not be some association, a symbyosism, as it exists in many other superior mushrooms and chlorophylic vegetables of every order, trees, herbaceous plants, algae, etc?

Nothing is more simple to illustrate than this hypothesis. In a large glass bowl covered with a tin lid, we press down the made manure until it fills the two lower tiers of the bowl; we will cover the surface with a bed of earth, and sterilize the whole. Then let us sow the lower part with germinating Agaric spores, taking all precautions desirable for the culture to remain pure to the end. Thus we estimate that the mycelium, in the absence of all living microbes, will develop itself there just as well as in the grower's cave, that it will manifestly grow in substance, and that it will fructify at the end of some months of vegetation.

The hypothesis of a symbyosism supposed to exist is then cast aside; if the microbes are useful to the Agaric, they are only so by the elaborated products which are taken into its system. We are thus led into the domain of chemistry.

Since the works of Deherain, Gayon, Schloesing and others, we know that the transformations produced in manures are of two orders: one is due to microbean fermentations; the other to chemical combustion, which is always formed of cellulosic substance in a sufficient state of division and humidity, as in hay, tobacco, etc., are accumulated and stored in great volume. Mr. Schloesing, in operating simultaneously on some lots of sterile and non-sterile manure, determined the part which returned to these two phenomenal classes in the ordinary conditions of the manufacture of manure. He has shown that microbean fermentations, the acid fermentations of a first soluble matters, followed by fermenic fermentation of the cellulose, lasts until about the third day, and as long as the temperature does not attain 80 degrees. At 80 degrees both completely cease, leaving the field free to chemical combustion which grows in intensity as the temperature rises. Knowing this we suspect that microbes do not play the principal role in the manufacture of manure used by mushroom growers. In fact it is exclusively in the interior of the planchers that specific transformation is produced; now, in these places a temperature of 80 degrees to 90 degrees is maintained, and the gases produced, some of which I have weighed, have never been of a combustible nature. In order to push the demonstration further, I have instituted different

kinds of experiments in which I have acted on chemical combustion only. To do it I have closed in sacks or large glass bottles, finely ground straw from the mill, moistened it and buried it in the center of a plancher in full fermentation, the temperature of which was not lower than 85 degrees. At the end of twenty days, the lots of straw which had not been aired during this time, did not offer any sensible modification. On the other hand, those which I had been careful to air had lost from 25 to 30 per cent. of their weight, turned a brown color, and presented nearly all the traits of the best mushroom manure. They differed only on one point: the fragments of straw were not disintegrated, they had kept to their cohesion and rigidity. It was evident that the straw had undergone, at least superficially, chemical oxidation, although the high temperature to which it had been continually exposed, did not permit of the cellulose ferments accomplishing the work of destruction of pectic substances, which serve as intercellular cement, the high effects of marked retting had not been able to produce it.

Upon the straw thus prepared, I transplanted some portions of Agaric mycelium; they prospered perfectly, and fructified as well as if on the mushroom manure, although less abundantly. This is easily understood since the transformation of the straw had not been so complete.

In order that I might nearer approach practical conditions, I added some of the lots of straw having a strong proportion of ammonia or carbonate of ammonia (5 to 10 per cent.). The results were yet more decisive, combustion was more rapid and greater, and straw thus treated will prove itself superior as a nutritive center for the Agaric. I do not know how to explain the favorable actions of the ammonia upon the oxidation of the straw; but it is extremely marked, and sufficient in itself alone to be of account in warming the planchers, without which it might be necessary to invoke the intervention of the microbes. Thus I have estimated that a sack of ground straw, moistened with a solution of ammonia, and pressed down tightly, increased the temperature in 24 hours, from 30 degrees to 40 degrees. With larger masses one could easily carry the temperature to 80 degrees. It must be remembered that this property belongs only to ammonia and carbonate of ammonia, neuter ammoniacal salts do not possess it. neither do the nitrates which exclude the hypothesis that ammonia acts favorably for the food of the microbes.

Now in resuming, to make straw a proper matrix in the culture of the Agaric, it is enough to make it undergo a certain degree of chemical oxidation, which may be perfectly obtained without the intervention of microbes, especially if care is taken as I did in my experiments to pulverize the straw. Here we gain the key to the methods followed by mushrooms. The straw bruised under the feet of horses, absorbs

the urine in full ammoniacal fermentation, maintained by the waterings to a constant degree of humidity, pressed into a compact mass, aired anew each time when necessary, by means of turning it over, presenting the most favorable conditions one can think of to furnish an easy aliment for chemical combustion, and to rapidly carry it to the maximum of its intensity. In fact this is what happens to the planchers nearly as soon as they are constructed, and if the heat does not come generally to about 90 degrees, it is because to this temperature the phenomenon moderates by the rapid evaporation of the water and the drying of the straw.

As to microbes, their role is to favor chemical combustion by raising the temperature from the first moment following the establishment of planchers, but above all, and this applies principally to formenic ferment in dissecting the straw and exposing each one of the fibres which make up the stubble.

The manure after fermenting as stated, remains from a chemical point, a mixture of infinite complexity, of which a complete immediate analysis could not be possible in the actual state of science. We should, therefore, hesitate to say more under these circumstances. If the manure is collected, worked up by the water warm or cold, it is found that these liquids do not possess any nutritive qualities for mushrooms, even if a sub-stratum of porous consistency is incorporated as that of manure. On the other hand, the manure worked up by the water, rids itself of all the soluble properties with which it was impregnated, without losing any of its nutritive value; the mushroom grows and fructifies normally. We learn from this experience, that it is an insoluble substance in the water which is utilized by the Agaric, and from that it is certain that it is amongst cellulosic matters that this substance should be looked for.

The notion of an insoluble food in the water, under its primitive form, is not a new idea in vegetable biology, especially cryptogamic biology. It will be sufficient for us to refer to the fecula, the sister of cellulose by its origin and by its properties.

In that which concerns cellulose itself, we possess a number of facts which prove that these composts are assimilable, not only for herbiferous animals, but also for a number of cryptogams. We are ignorant, it is true, as to what are the conditions of this assimilability; whether the cellulose has need of being hydrologised by the independent action of the mushroom; whether it is necessary that it be transformed by oxidation in oxycellulose, or yet divided into several fragments. We do not exactly know the mechanism of a mushroom from the manure. The destruction of all soluble organic matter which is dispersed and worked up by bacteria, or scalded by oxidation, is certainly an important factor, because it prevents the simultaneous action of microbes and moulds and sterilizes the soil to the profit

of the lone Agaric. But we may believe that oxidation of the cellulose of the straw has the direct result of making it more assimilable for the Agaric. On this subject I will refer to the works of Cross, Bevan and Smith,* who have shown these oxycellulose, that is to say, cellulose having already undergone a beginning of oxidation, continue to oxidize under the lightest influences to 100 degrees heat. Now the great consumption of oxygen which makes Agarics so that the release of heat, with the formation of water and carbonic acid which accompanies its growth, shows sufficiently that the nutrition of this cryptogam depends before all else on a condition of oxidation. What is certain in this case is, if a lot of ground straw is prepared, and all matters extractive by warm or cold water, alcohol or ether, are taken out, sterilizing it, the Agaric will not fructify, while it will be abundantly prolific on the same straw after undergoing chemical oxidation. Observation of natural facts speaks in the same way, for it is not rare to meet *Psalliota campestris*—the common mushroom—on roots, leaves, sawdust of half rotten wood, and even on pasty paper which has for a long time been exposed to dampness. It is never found on new wood. It is not rash to suppose that the majority of superior living saprophytic mushrooms like the Agaric, depend on cellulose. If it is really so, one understands why all the attempts at culture of these organisms have up to the present time failed. It is because search has been constantly made to make for them nutritive spawn with soluble products extracted from their natural sub-stratum, whilst it is the insoluble part of this sub-stratum that must be looked for.

I hasten to add that in order to cultivate a superior mushroom it is not enough to give it the cellulose which it likes. It needs also, and that is where the difficulty lies, to have it in an assimilable form. If it is believed that for a cave mushroom a simple oxidation is sufficient to modify the cellulose, I am in possession, on the other hand, of facts which give rise to the thought that for other superior mushrooms, the preparatory transformations which it must undergo are more complex and are probably realized by the intervention of the microbes.

In all cases, the complexity of the molecule of cellulose, and of the great number of different celluloses existing in the vegetable world, gives us to understand the close specialization which many of the superior mushrooms affect in relation to their habitats, and the affinities which one notices between some of these mushrooms and such species of Phanerogams of which the organs, dead or living, seem to have the privilege of extending to them hospitality. In this order of ideas, one may say that the progress of biology in the higher class of mushrooms is closely allied to that of the chemistry of cellulose sub-

* These able works are presented amongst numerous communications to the London Chemical Society, Berlin, etc. M. L. Olivier has a notice of them in La Revue of July 15th, 1896, page 601.

stances. I do not wish to dwell here on theoretical considerations, but cannot help making a comparison between the nutrition of superior saprophytic mushrooms and that of species of the same group which live in symbiosis with green plants. This symbiose, it is known has already been demonstrated in a number of cases, and it is probable that nearly all the Basidiomycetes which have an affection for the neighborhood of certain trees, have their mycelium associated in the roots of these trees under the form of mycorhyzes.* The assimilation of carbon is effected by the superior mushrooms through two distinct processes; the one is associated and participates with green plants in some way to the benefit of the chlorophyllian function; the other selects for food certain hydrocarbonated compounds, of which combustion procures for them at the time carbon and the necessary strength to secure this carbon.

Now it is a curious fact approximate to show the relation which binds these two modes of existence so divergent in appearance, saprophytism and symbiosism, which in either case are interchangeable. The thing is at least certain for *Psalliota campestris*, in fact I have estimated that in fields where this mushroom is gathered in abundance, its mycelium is constantly associated with the roots of gramineous plants with which it forms mycorhyzes analogous to those of Cupuliferes (f). This mycelium instead of taking the development which we know it does when it grows on the manure heap, is then reduced to scarcely perceptible filaments which take the place of rootlet hairs, and one can know them only by the characteristic odor, and by the appearance in autumn, of carpophores, the dimensions of which seem out of all proportion with those of the vegetative character. The proof in question of a symbiosis is that the tufts of Graminea which hold these mycorhyzes, are distinguished from all by the grandeur and dark green tint of their leaves; they can be seen in the distance on prairies, where they form circles which seem to grow larger each year, as those of *Marasmius oreades* (g), (another Agaric guest of the Graminea). The green plant in its turn associates with the mushroom, and shares the elaborate azotic food of the latter, probably by fixation of atmospheric azote. In transferring with proper precaution these mycorhyzes of the rural Agaric from the manure pile, or better in putting the manure in prolonged contact with the roots left in place, acclimation of the mycelium is easily obtained from this new center. Here then is a mushroom which supplies the absence of the chlorophyllian function, sometimes by saprophytism and sometimes by symbiosism, and which passes from one to the other without any other apparent modification than to fully develop its vegetable ap-

* See the remarkable article about Mycorhyzes by M. Vuillemin in La Revue of June 15th, 1890.

f. "Larder"—In American culture "spawning" is the technical term.
g. This would mean the roots of oak or beech trees.

pearance in the second case. But let us return to the manure used by mushroom growers. From the study we are making, it seems that the best manure for mushrooms is produced from chemical oxidation of straw, and not that of bacterian fermentation. In fact not only the action of bacteria has not resulted in making the cellulose which they encounter assimilable for the Agaric, but further their appearance in such large proportions is noxious on account of the products of putrifaction which they make, and which are eminently poisonous for the Agaric.

The causes which tend to moderate combustion, and favor the invasion of bacteria, or in other words, the rotting of manures, are three; the excess of humidity in manures, their too feeble supply of ammonia, and the presence of putrescent organic matter.

Water in a free state in manure dissolves the extractive substances of the straw and transforms it into a veritable bouillon of culture, in which bacteria soon swarms. Further it acts physically in hastening the mise on the road of chemical combustion; for if the test is repeated with straw, not simply moistened but diluted, the spontaneous heating experiments which I have related above constantly fail. It is doubtless because it obstructs the pores of the straw rendering it impermeable to air, that the water in excess hinders oxidation. It is necessary then to use carefully the water which is poured on the manure; it is a great error to believe that the same result will be obtained by immersing at great intervals, then sprinkling moderately. Accidents occur too frequently, unfortunately, that prove the disastrous excess of water. Often it happens during very rainy seasons, that the good results of planchers in course of manufacture have been lost.

We have seen that ammonia is a weighty factor of spontaneous heat in manures; that its presence in strong proportion favors the formenic ferment to the detriment of the bacteria of putrifaction, because this ferment may support a degree of alkaline much higher than the greatest quantity of microbes. For this double reason, manures little charged with urine and those which have been washed by rain, heat with difficulty, and are always more or less subject to get rotten. Quite a practical way of remedying the poverty of manures would be the addition of true Peruvian guano, rich in uric acid. But the past few years this guano is no longer found in commerce. On the other hand, the use of ammonia in nature would be much too troublesome to be considered. I have wondered then if it would be possible to supply it in a certain degree by means of carbonate of soda, which has not, like ammonia, it is true, the direct influence on the intensity of chemical combustion, but may, nevertheless, produce a useful effect on bringing the manure to a degree of alkali sufficient to obstruct the bacteria of putrification, and allow the formenic ferment to be uppermost. This treatment, which up to this time I have had only one

opportunity to try, gave me such encouraging results that I may recommend it to growers, the case occurring. It is essential that salt be added at the same time with the construction of the plancher; later the bacteria will have already accomplished their work.

It now remains to speak of secondary changes which may occur unexpectedly in the manure in the mows, during the propagation of the mycelium. We shall here be checkmated. The reason remains a mystery to the most expert mushroom grower. But the subject demands new study, and we will treat it elsewhere than within the limits of this article.

CHAPTER III. STUDY OF THE PHYSIOLOGY OF THE "BLANC." (h)

The mycelium is the vegetable make up of the plant, of which the mushroom proper is said to be the fruit. This mycelium is at first composed only of simple filaments, inosculated without order to each other; it is the blanc mosseux of mushroom growers, which we will call amorphous mycelium. We have seen at the moment when the plant prepares itself for reproduction, the mycelium filaments reunite to form cylindrical cords relatively voluminous. It is the preliminary step towards a higher organization, more complicated than by the intermedium of the rhizomorpha on a rocky bed, which one comes across in some agricultural situations, fastened directly on the stems or roots of vascular Cryptogams and Phanerogams. The cells entering into the constitution of the mycelium cords are then cells which have already attained a certain degree of differentiation. Now we know that in proportion as a vegetable cell differentiates, it becomes less able to produce a new plant when it is detached from the individual of which it was a part. Whilst the amorphous blanc may be able to propagate indefinitely the Agaric without which the race loses none of its vigor, the blanc in borders transplanted, will give at each new generation only a meagre vegetation, and a very poor fructification. In cave culture, the differentiation of the mycelium makes very quick strides. It remains amorphous only in its youngest parts; that is to say, in a peripheric zone of some centimetres of breadth. It is then almost exclusively with the blanc already differentiated in the borders, that the mushroomist stores his mows. In order to better judge the merits of a variety, they are in the habit of securing, before raising the blanc, the growth of some early mushrooms.

To this first cause of exhaustion of the race there is another to be added. In the mows the mycelium experiences a temperature very much higher than that of the soil of its native place. It may even be exposed to "fire strokes," that is, sudden elevations of temperature, attaining 30 to 35 degrees. Now the tests which I have made on this subject have demonstrated that to start at 30 degrees the mycelium

h. These circles are known to the English as Fairy Rings.

suffers; and that if this temperature is prolonged for some days it leaves it positively diminished in vitality, weakened absolutely, as pathogenic microbes are weakened by heat. The mows set aside for the production of the blanc are only in the coldest of caves. Notwithstanding these precautions it is always a complaint that mushroom cultivation has a progressive degeneracy, which tends to lower the value of the first gathering. When it is a question of flowering plants, exhausted by a series of successful cuttings, the horticulturist has resource to the seeds. The mushroom grower cannot resort to this radical method, because he has no way of obtaining reproduction of the mushroom by spores. He is forced to make his blanc young again by culture at low temperature; he trades with those of his confreres, in hope that the changing of the product will exercise a favorable influence; above all he tries to procure it from the "virgin blanc," meaning the blanc which grows spontaneously from a chance spore, carried in some manure which has been exposed undisturbed for a long time.

Searching for the blanc vierge has become a sort of industry for a certain number of professionals who scour the country for about fifteen or twenty leagues around, bringing back manures, portions of old melon patches, etc., only to be disappointed in the end. The blanc is conceded by growers as a high prize, not in money value but in the chance to prove the strongest among a mass. He must in fact not only detect the false which is abundant, but be able to perceive the exhausted blanc vierge, and also ascertain the varieties, and their several cultural value.

They have therefore to search hill and dale, far and near, before finding the one which gives the most satisfactory results. Such as it is, the blanc vierge remains the only source to which the grower may apply for keeping up his supply, and one can understand why the question of the blanc is a sort of vital part of his industry.

The idea of propagating from the blanc vierge by germinating some spores, ought to induce reflection. In fact it has often been suggested, not so much by business men as by botanists. Nothing is easier than to procure Agaric spores, all that is required is place a mature mushroom over a sheet of paper. At the end of a few days the spores fall from the hymenium, covering the sheets as with brown, impalpable dust. The difficulty is to make these spores germinate, Chevreul serves us here, at least the method which he contributes is certainly susceptible of giving good results. However, it seems that his method has not been followed. It is only recently that the study of this question has been taken up, independently and simultaneously by Messrs. Constantin and Matruchot on the one hand, and by the author of this article on the other.

There is no mystery in germinating the spores of the Agaric. They

may be obtained on any nutritive medium used in bacteriology, on a mouldy sand, or simply in a damp atmosphere, as well as on the manure heap. Doubtless this germination is not produced with the same spontaniety and rapidity as that of the spores of common mushrooms. It is necessary to stimulate artificially, but this knowledge is only acquired by operators, after many fruitless experiments. The spores which ought to germinate (and they are always in the minority) commence by swelling and turning to a clear color, then throw out at the ends a very fine germinating tube, which broadens immediately and branches in every direction by budding. Thus is made a little mycelian tuft which seems to desire nothing more than to extend itself indefinitely towards a favorable medium, such as the manure heap. By this simple method the blanc vierge is obtained at will. It is used industrially in the manufacture of white mushroom husbandry which I have made, as warranted by my researches, in contrast with some other improvements which have entirely transformed the quality and the product. As to the use of mows which give a scarcely homogeneous pure blanc, exposed to fire strokes, and favoring the formation of borders, of which we know at a glance the sad signification of the vitality of the blanc. I submit the following process: The manure is distributed in beds of equal thickness between some superincumbent sheets of steel, and the whole is placed under a strong pressure of 50 kilos to the square centimetre. In removing the manure it is found pressed into slabs of about one centimetre of thickness, nearly as strong as wood and consequently very easily handled. The slabs are spawned, then placed in the most favorable conditions for the development of the mycelium, taking especial care to avoid any high temperature. The growth of the blanc is thus retarded, but its strength and vitality when transplanted in the lukewarm atmosphere of the caves is to be considerably increased. When the slabs of manure are wholly permeated by the mycelium they are cut up in sections of eight centimetres on a side, each one of which represents a brick. This operation is very rapidly done by means of a machine especially devised for the purpose. This avoids much hand labor demanded by the ordinary system, and finally obtains a product more economical and convenient for use than the usual spawn of mushroom growers. It is superfluous to point out the happy influence which this innovation cannot but exercise on the cave mushroom industry. The problem of revitalizing the old is now solved once for all. In addition the grower has henceforth the power to select the variety which succeeds best in his cave. He has the advantage of a spawn seed-plot that faithfully preserves the morphological and physiological peculiarities of the original race. In short, this pure spawn bed is exempt from disease, a consideration which as we shall see is also of great interest.

CHAPTER IV. DISEASES.

Mushroom gardens are frequently ravaged by diseases in which still lower Cryptogams are the active agents. It is necessary to distinguish the true parasites amongst these Cryptogams, which even live in the same tissue with the mushroom; and the saprophytes which content themselves with entering into vital competition with them, and ousts them more or less completely from the ground which was meant for them.

The most redoubtable of the first class is represented by *Mycogone rosea* (Magnus, Prillieux). The disease which it occasions is called the *molle*. Mushrooms attacked with molle are already distorted before achieving their growth; the cap is deformed and consumptive, the stipe is globulous, and as it thickens, the mushroom covered with pale red colored down, formed by the conidiferous filaments of the parasite. Finally, at the time when it should be at its maturity, it becomes soft and deliquescent, exhaling an infectuous odor. The damage caused by the molle is considerable. It is estimated by Parisian growers by millions of francs.

Among the saprophytic enemies of the Agaric is one known as *verdigris*, caused by *Myceliophtora lutea* (Constatin); the *platre*, the creamy white strips of which exposed on the surface of the mows, are like colonies of a kind of *Odium* (*Monilia fimicola*); and lastly we have the *chanci*, of which the filaments are woven into a net work, belonging to, according to M. Constatin, to species of agaricines, *Clitocybe candicans* and *Pleurotus rutilus*.

There has as yet been little research into the proper methods of battling with these diseases. M. Constatin says that they perpetuate themselves in cultivation by means of spores, and he advises disinfecting the cave by sprinkling with a solution of lysol. I may here take occasion to note a distinction between saprophytes and *Mycogone*. In my opinion the disinfection of caves will not render any service against verdigris, platre, or chanci, for these diseases are often only the consequence of imperfect preparation of manure. Sometimes however the manure is of good quality, it is then the spawn, proceeding from an attacked mow, which is the agent of contamination. Outside of these two circumstances Agaric mycelium is always victorious in disputing the ground of the saprophytes of which we speak. The role of the spores of these Cryptogams which may be diffused through the cave is not then quite apparent; especially if one believes that the manure always bears with it a complete assortment of them.

It is certainly otherwise concerning *Mycogone*, a real parasite of which the propagation is independent of the quality of the manure. Here two quite distinct cases should be considered: 1st, the spawn which was used for bricks was already infected by *Mycogone*, and

the molle showed itself the first opportunity; the crop is a total loss; 2d, the spawn was free, but the cave was infected with spores proceeding from the weaker culture; in this case the mushroom having the advance of its enemy will generally be able to give one or two crops before the molle has much power and the damage is slight. Observe the two cases from a practical point of view. I have seen, notably, examples of disease carried by the spawn, in mows ravaged at the outset by molle, by the side of outer mows made with the same manure, and covered with a good crop. The reason of this contrast is that the one has been spawned with the blanc vierge, and the other with the spawn proceeding from caves where the disease rules. The grower is then assured of battling successfully against the molle, if he will take two precautions only: 1st, to use only the spawn surely exempt from disease, and in this respect the seed spawn offers a guarantee which is not found elsewhere; 2d, make healthy caves after each crop, by immediately turning over the used manure and the degoptures, that is to say, the soil which was used in goptage, and proceeding to give a general disinfection as M. Constatin advises, only I do not believe the spraying of lysol praised by the author, to be a very practical proceeding. Whosoever knows the difficulties presented by effective disinfection of premises, will scarcely admit the possibility of disinfecting by spraying an underground cave of several thousands of metres of surface with windings and fissures with which the walls are riddled. I believe that it would be preferable to resort to sulphuric acid. In burning the sulphur in the cave, after having closed all the openings, the spores of the fungi would certainly not be destroyed, but would be at least retarded in development and limited in invasion.

CHAPTER V. STATISTICS.

In the department of the Seine there are 250 mushroom grounds. Formerly nearly an equal number of distinct establishments were counted; but in consequence of combination their number to-day is found to be reduced to 70 or 80, to which it is allowable to add a score more, dispersed in the neighboring departments. In revenge as it were, these establishments are generally more important than they used to be. Some employ a hundred workmen, others from forty to fifty. The whole number must exceed a thousand, and the value of the products of the buttons is from six to seven millions of francs. The culture of the mushroom is not at all in decadence, on the contrary it increases every day, as fast as, indeed, the enlargement of the caves will permit. Certainly it has in many respects become a leading industry. The proprietor quarries the stone which he delivers at cost price, solely to be able to extend the mushroom business. The cost of manure constitutes the leading expense to the grower. The time

has passed when stable manure in Paris could be had for nothing merely for the taking away. To-day it is bought for the year by contractors who carry it to mushroom growers, for from 7 to 10 francs for 1,000 kilos. Half of the manure produced in Paris goes to the mushroom growers, and comes back again under the form of compost which cultivators of forage plants, especially in the environs of Paris, eagerly secure.

All expenses included, the running metre of mows represents on expenditure of from 2.50 to 3 francs. To cover this expense and leave a profit for the grower, he must attain a crop of 3 to 4 kilos per (i) metre, and this providing that the price per kilo does not go down in the market below one franc.

Unfortunately it sometimes happens of late years that this minimum was not attained during a great part of the summer; doubtless the demand for mushrooms was lessened by the abundance of other vegetables at this season, but also and more especially on account of the canning factories which use a large quantity at ordinary rates, then suspend their purchases in order to can green vegetables.

In order to avert this crisis which is renewed periodically, and which threatens to give a fatal blow to the industry, growers, giving thus an example of good business astuteness, have founded a kind of co-operative society of producers, and have erected, at a common expense, a canning factory, in which they handle themselves a part of their crop during the whole period of the season, whenever the market prices descend below a certain limit.

Notwithstanding all, it is not probable that one will ever again see in France the price of 2 francs and 2.50 francs the kilo, which is still in vogue in countries where the culture in caves is little developed, in England and the United States for example. But if French growers are less favored than their foreign brethren for home sales, they have the resource of exporting canned mushrooms at a price which is an equivalent for them. Thousands never see a fresh mushroom. French canned mushrooms will defy all competition in foreign markets. The exportation of French mushrooms, already important, is still on the road of continued expansion.

It is then to be hoped that the culture of the cave mushroom will remain a prosperous industry, especially if growers, impressed with the value of scientific knowledge in presenting facts, and eliminating errors, will set aside the capricious methods of to-day. We shall be happy if the researches here detailed contribute to this grand result.

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1. Blanc must be understood as virgin spawn.

THE TOBACCO LEAF MINER.

By GERALD McCARTHY, B. Sc., *Entomologist of North Carolina.*

In the spring of 1896, considerable excitement was aroused among the tobacco growers of North Carolina by the discovery of a new insect pest of the tobacco plant. This insect appeared in destructive force quite suddenly in the tobacco fields of one of the eastern counties of that state. The people of the locality supposed that a new pest had been introduced from some foreign land. The North Carolina Experiment Station dispatched an agent to investigate the matter at the point of the outbreak. Specimens of the insect there collected proved it to be a native, rather rare, and up to that time, harmless species of moth known only to entomologists as *Gelechia piscipellis, Zeller.* The natural food plant of this insect is the Horse or Bull nettle, *Solanum Carolinense.* This nettle and the tobacco plant, together with the tomato, Irish potato, egg-plant, Jamestown weed and other less known plants all belong to one and the same natural family of plants, namely: the *Solonaceae.* The insect *Gelechia piscipellis,* belongs to the natural Order *Lepidoptera,* sub-order of moths; family of Tineids or clothes and fur moths. Its nearest well known relative is *Gelechi* (*Sitotroga*) *cerealella,* the pest too well known under the names of Angoumois grain moth and fly weevil. *Gelechia piscipillis* was first described by the German entomologist Zeller in 1875, who received his specimen from Texas. Zeller, however, did not know its food plant. This was discovered by Miss Murtfelt of Missouri, who in 1881 published a description of the insect bred from larvae found feeding on the Horse nettle. The description of the insect, freed from technical language is as follows:

Head very light yellow. The palpi nearly white, the feelers ringed with light and darker bands. Forewings narrow, about one-fourth inch long. The general color is light ochre yellow copiously sprinkled with black and white dots or streaks towards hind margin and tip. The hind wings are very narrow, about twice as long as wide, fringed on hinder margin with long hairs. The under sides of both pairs of wings are much lighter colored—approaching to grayish—than the upper sides. The total spread of wings is about one-half inch. The length of the moth is about three-eighths inch. The larvae when hatched is nearly pure white but grows darker and greenish as it approaches maturity. Its head is dark red or blackish. Each seg-

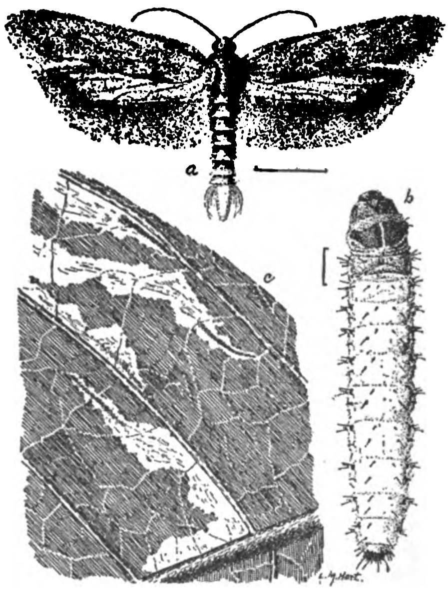
ment of the body has on the sides a small clump of dark bristles and a few isolated hairs are scattered over the body. The legs are very small. The length of the mature larvae is about one-fourth inch.

In the United States about sixty species of Gelechia are known to exist. These feed upon various plants but a greater number of species feed upon plants of the *Solanum* family than upon any other. In Europe over 100 species of this genus are described. Most of these mine the leaves of plants belonging to the natural Orders *Leguminoseae* (clover family) and *Caryophyllaceae* (pink family).

The Angoumois grain moth is a European species introduced into this country about 1852, with wheat imported by the Patent Office at Washington.

THE METAMORPHOSES OF INSECTS.

Before entering into the details of the life history of the tobacco miner it will be well to take a brief glance at the metamorphoses of



insects in general. Without such knowledge on the part of the reader much of what we have to say of the tobacco miner would be scarcely intelligible to most readers of this report.

All insects are hatched from eggs, and all the eggs are produced by insects, but which originally came first the egg or the insect is a disputed point which no man has yet arisen to decide. From the egg of a moth or butterfly hatches the animal known to all as a caterpillar, scientifically called larva. The caterpillar or larval stage of a moth's life is its period of growth. It is the period of most interest to farmers and gardeners, for it is during this stage that the insect

does whatever damage it is capable of doing. The caterpillar stage of a moth's life lasts between two and three weeks in summer and somewhat longer during the cooler weather of spring and fall. Many species of moths pass the winter months in this stage benumbed, or even frozen solidly, by cold. During this larval period, in the warm season, the insect is a voracious and insatiable feeder, commonly consuming more than twice its own weight of food daily. It usually casts off its old skin once a week during the larval stage.

Finally, when it has become full grown and its interior has become a mass of fat, the animal stops eating, rests for a day or two and then seeks some secluded spot where it casts its old skin for the last time and spins a pupal case or cocoon, or wraps itself up in its old skin and passes into the pupa stage. A common example of an insect pupa is the dark brown boat shaped objects attached to the under sides of cabbage leaves in summer. These are the pupa cases of the striped cabbage caterpillar. In the pupa stage the insect spends from a week to twelve days in summer and longer in cooler weather. During this period the animal takes no food whatever. A most wonderful transformation goes on within the pupa case. Literally the entire body of the caterpillar except the skin and its appendages melts into a semi-fluid mass, losing all trace of its former arrangement into special organs, such as stomach, muscles, nerves, etc. In this disorganized mass a number of shining dots soon appear. These are the new centers of organization, around which grows up each in its appropriate place, the various organs of the winged moth. We must understand fully that no organ of the caterpillar ever grows into or assumes the form or function of the similar or analogous organ in the moth. Every organ and part of the moth is built up anew out of the disorganized semi-fluid body of the former caterpillar. When this reorganization is at last completed within the pupa case, the case splits down the middle of the back or the front end is pushed off like a lid and the moth, like the goddess Minerva, full grown and mature, springs forth. No moth or butterfly ever grows the smallest particle after issuing from the pupa case. So sudden, so complete and so wonderful is the transformation from the sluggish, earth-creeping caterpillar to the beautiful, swift-flying, sky-loving moth, that the ancients regarded the transformation as typical of the human soul. They therefore called the butterfly and soul by the same name, *Psyche*.

As the caterpiller stage was the vegetative or growing period, the winged or moth stage is the reproductive period. The length of the life of a butterfly or moth in summer is commonly not over two weeks. The sole business of the winged insect is to lay its eggs. During this period very many species of moths eat nothing whatever, having only imperfect and useless mouth parts or none at all. Those which do take nourishment live exclusively upon the nectar of flowers, the

juices of fruits and sap of trees. They never chew or gnaw leaves, they never bite or sting.

We are now in a condition to understand the following facts:

LIFE HISTORY OF THE TOBACCO LEAF MINER.

In the spring soon after the young tobacco plants are set in the field the mature insect or moth *Gelechia piscipellis* is seen flying about the field at dusk, alighting frequently upon the leaves of the young tobacco plants. The moth has recently emerged from the pupa case where it passed the cold season. Alighting upon the leaves of the young plant the female moth thrusts her hollow ovipositor or egg-tube into the leaf usually near a rib. Through this tube she pushes an egg into the leaf just below the skin. This wound made by the ovipositor soon heals over and the egg is safe, snugly covered and protected. Usually several eggs are placed in each leaf, but never very close together. The egg, which is about the size of a small pin head, hatches in three or four days. The young caterpillar it at first too small to be easily visible to the naked eye, but grows rapidly, attaining when full grown a length of about one-fourth inch. It eats away the green matter of the leaf, leaving the outside skins or epidermes untouched. It turns and twists about, forming what is called a blotch mine. When in the course of its wanderings it strikes a rib it usually follows the course of the rib for the rest of its career, but if the leaf dries up it will bore into the rib. It continues to eat the leaf for about three weeks. It then comes out of its mine and drops to the ground where it spins about itself a tiny white cocoon resembling that of the silk worm, but only about the size of a grain of rice. The cocoon is generally placed under a stone, clod, or covering of some sort. It is often found under the "primings" or lowermost leaves which are pulled off and usually left on the ground. The pupa stage lasts only for a week or ten days in summer. Then issues the winged moth to lay eggs for the next succeeding brood of caterpillars. In North Carolina there are two or more successive broods on the growing tobacco and maybe one more on the sprouts of the stumps left after the crop is harvested. Where there are no sprouts the wild food plant, *Solanum Carolinense* may serve the insect. Finally, when cold weather comes on the larvae seeks some place of refuge, changes to the pupa and there lies dormant until the warm days of early summer.

NATURAL RANGE OF THE TOBACCO LEAF MINER.

As soon as the identity of the Tobacco Leaf Miner was established circulars of enquiry were sent out to every county in North Carolina and to the chief tobacco centers of neighboring states. The facts of the case were also widely published in the newspapers. These brought out replies showing that the insect exists over a very

wide range, but is nowhere common. It has so far been known to injure tobacco only on the sandy lands of North Carolina and the still sandier soils of Florida. In both these sections the wild food plant of the insect *Solanum Carolinense* is quite abundant. The insect is, however, known to be indigenous to all the country from Pennsylvania to Florida and from the Atlantic Ocean to the Mississippi. The insect undoubtedly exists in the rocky hill lands and the dry soils of the coal fields of Pennsylvania.

THE PRESENT IMPORTANCE AND POSSIBLE FUTURE OF THE TOBACCO LEAF MINER.

So far the damage actually done by the Tobacco Leaf Miner is not great, though it is very likely that much of the damage imputed to the "horn worm" is really the work of the leaf miner. As a suggestion of the possible future of this insect we may take the career of the notorious Colorado potato beetle.

The potato beetle, *Doryphora decimlineata*, was originally native and confined to the dry western plains abutting against the Rocky mountains. Its food plant was another *Solonaceous* weed, *Solanum rostratum*. On these western plains before the advent of the agricultural settler and the building of irrigating canals, the herbaceous vegetation was very scant, consisting of tough grasses, loco weeds and the above named *Solanum*. The Irish potato plant is botanically *Solanum tuberosum*. When these dry plains were irrigated they were found to produce enormous crops of Irish potatoes, which soon became extensively planted. The beetle which had hitherto for untold ages led a precarious existence dependent on the scant nutrition afforded by the wild Solanum quickly discovered the superior quality of the cultivated species—the Irish potato of agriculture. The relatively enormous increase in its food supply by changing from the native to the cultivated Solanum caused an equally great increase in the reproductive powers of the beetle. This increased reproduction proceeded year after year in geometric ratio. The insect soon overflowed its former bounds and then step by step and state by state it progressed eastward, becoming a destructive pest wherever the Irish potato was grown. Eventually it reached the Atlantic Ocean, which for a few years only proved an effectual barrier. Finally it passed even the ocean and is now in Europe as well as America, the most formidable foe of the Irish potato. Since it began its progress this insect has cost agriculture many millions of dollars and will cost many millions more! It is within the bounds of possibility that the tobacco miner may spread and damage the tobacco crop to an extent relatively as great as the potato beetle has damaged that crop. This, however, is not probable. When the potato beetle began its devastating eastward march, economic entomology was scarcely born. It was nobody's business to look after such pests or provide methods for combatting them. Very few farmers or other people

whose crops are damaged by insects can get time to study the life history of even the most common pests. Without such knowledge no really efficient treatment is possible. In a complex civilization men must ever become more and more specialists and each work for the good of all. This law has called into existence official entomologists, in all the more progressive states. The United States now leads all nations in the excellence and efficiency of its work in economic entomology. Now the presence of a new or threatening insect pest is at once detected by the State Entomologist, and the most effective treatment is soon discovered and the people interested are instructed how to apply it. Where the entomologist is efficient and the people wide awake, it is neither very difficult nor very expensive to prevent the disastrous spread of such pests provided they are taken in hand in good time. Here we have a very emphatic illustration of the old saw about the "stitch in time which saves nine."

REMEDIES FOR THE TOBACCO LEAF MINER.

In order to deal most effectually with any insect pest, we must first study its life history and its most vulnerable point. In the tobacco leaf miner we have to do with a foe who has very few weak points! The parent moth deposits the egg beneath the surface between the two skins of the leaf. Here the young caterpillar finds its food around it as soon as it is hatched. The tough, oily skins of the leaf prevent any insect poison, whether applied as a spray or as a powder, from reaching it. It is also by the same means protected from insect eating birds and predaceous members of its own class. The indirect or preventive method of treatment only is practical. We may observe the following five rules:

1. The caterpillar, more especially the first brood, which always infests the *lower most* leaves must be sought for and crushed within its burrow between the thumb and finger or remove and destroy these leaves, which are commonly worthless commercially.

2. The soil beneath the plants, at least the first half of the season, should be kept as fine and mellow as possible and be frequently stirred. This will prevent the insect from finding a hiding place beneath which to pupate or will bury the pupa so deep that it will die there.

3. The primings of the plants should never be thrown on the ground. Remove and compost or bury them. This worthless trash besides being liable to harbor the immature caterpillars nourish also various species of noxious fungi which causes more or less damage to the crop.

4. When the crop is gathered plow under the stalks as deeply as possible to prevent them from harboring the insect, and carrying it through the winter.

5. Where practicable plow up or kill with a spud all plants of the Horse or Bull nettle in or around tobacco fields.

THE POISONS DEVELOPED IN FOODS DURING FERMENTATION OR PUTREFACTION, WITH TWO ILLUSTRATIVE CASES.

By F. T. ASCHMAN, P. D. Ph. B.—*Chemist of the Department of Agriculture, Pittsburg, Pa.*

Among the many questions connected with foods and their supply, none have of late attracted so much attention, none have been the subject of so much study and experiment, and none have led to such important conclusions as those regarding the poisons which develop in foods under certain conditions. As a result, we find that while much is still to be learned regarding these poisons, yet many hitherto unexplained facts have been cleared up and the way pointed out how to prevent the production of these noxious substances and neutralize their untoward effects.

Food may act as a poison in three chief ways: 1. Certain kinds may be detrimental, at times at least, to a few persons, while serving as food for the majority. This is owing to individual susceptibility or idiosyncrasy, as is sometimes noticed in the case of strawberries, for instance, which not infrequently cause a rash and other disagreeable symptoms. 2. As a result of chemical and other poisons, introduced accidently or intentionally; and 3d, By the development of poisons owing to fermentative or putrefactive action. The first two modes of food poisoning, though of great interest, do not directly concern us at present, as it is to the fermentative poisons that we are to turn our attention.

Although it is highly probable that from the remotest times it must have been noticed that substances which had become spoiled or had undergone putrefaction, would seriously affect the human system if used as foods, it is not until quite recent times that scientific experiments were made to explain these observations. Formerly all such poisonings were looked upon as inexplicable or unavoidable, or were laid to other causes, or were even considered as direct visitations of Providence. The first record we have of a rational investigation into the origin of these disturbances is not until the eighteenth century, in the earlier part of which Albert von Haller made a series of experiments by injecting putrid matter into the veins of animals. He found that fatal results speedily followed. After him, Morand and Gaspard carried on this line of investigation by feeding decom-

posed meat and observing the results, and by also introducing putrid material directly into the blood of the animals experimented upon.

In 1820 the first suggestion as to the actual poison in the injected matter was made by Kerner, who ascribed it first to a fatty acid and then to a compound of sebacic acid and a volatile substance. Later, many eminent chemists and physiologists turned their attention to this interesting and important subject, among which we may mention Dupre, Schmidt, Stich, Panum, Schwenninger, Bergmann, Schmiedeberg, Zielzer, Sonnenschein, Selmi, Nencki, Schwanert, Breiger, Gautier, Etard and our own countryman, Vaughan, of Ann Arbor. Thanks to the researches and often very laborious studies of these and many other scientists, we now have a fairly clear idea regarding the cause of fermentative food poisoning.

Putrefaction is now known to be a series of processes, often very complex, during which various micro-organisms, generally bacteria, act upon nitrogenous organic substances (proteids or albuminoids) and split them up into a great variety of products, some of which are poisonous while others are entirely harmless. The proteids, of which the white of an egg or muscular tissue are examples, are the very complex substances which go to make up the greater part of the animal body, of some of its secretions, and also of various vegetable substances and of which the characteristic element is nitrogen. On account of their great complicity, these bodies are very ready to fall apart or, in other words, to decompose, especially when attacked by bacteria. There is as yet very little exact information as to the particular species which develop the poisons in foods by thus acting upon the proteids of the latter, but even this point will undoubtedly be gradually cleared up. Still less is known as to just how the bacteria bring about the decomposition, but it is probable that the products of putrefaction are what may be called the waste products of bacterial life. To explain by means of a more familiar example: When yeast is added to a suitable medium, such as for instance grape juice, it grows and breaks down the sugars, and as a result of its life, we have alcohol, carbonic acid and other substances, which are nothing more or less than waste, or by-products from the growth of the yeast plant. In a similar manner the bacteria decompose all the albuminous substances, a great variety of products resulting from this action. Of these, the most important in connection with the matter that we are considering are certain basic nitrogenous bodies, some of which possess intensely poisonous properties. This indirect action of the bacteria has only recently been understood, it being formerly held that the noxious effects of spoiled food were due directly to the introduction of the micro-organisms into the body. The importance of the observations of Letheby, who many years ago separated several poisonous principles from putrifying animal substances; of those of Dr. W. B. Richardson, who succeeded in isolating and proving the

remarkable toxic effect of a crystallizable base from a decomposing fluid; and of the discovery of Harquardt of a cadaveric alkaloid which he named septicin, were not at first properly appreciated. Some writers in fact attribute the discovery of the actively poisonous principles of fermented foods to M. A. Gautier, of France, and Professor Francisco Selmi, who are said to have simultaneously made this important discovery, the former in the course of chemical research, the latter during a legal investigation.

It is now pretty clearly established that the disastrous effects often noticed after the use of tainted food is in reality a chemical effect due to the poisonous principles produced by the bacteria. These poisonous substances are known as ptomaines (from the Greek word ptoma, a corpse), which name was given to them by Selmi, because of the fact that he first found similar compounds in an exhumed human body. They are also called cadaver alkaloids, this term referring to the great resemblance many of them have, chemically and in their extremely poisonous properties, to the vegetable alkaloids or active principles. The ptomaines are now distinguished from the so-called leucomaines, which are similar in their nature, by the latter being produced in the living body; and from the toxins which are the result of the growth of bacteria of various diseases.

The conditions for the formation of ptomaines are the presence, necessarily, of a nitrogenous substance and of the bringing in contact with it of a bacteria. Then we must have moisture and a medium amount of heat, varying in different cases. Electrical disturbances of the atmosphere also seems to promote the rapid production of these poisons. It is prevented by extreme cold and heat, by drying and by the presence of a preservative or antiseptic.

That the ptomaines are the actual cause of many cases of food poisoning, some of them fatal in their nature, is now acknowledged by nearly all authorities, and as a consequence, more rational modes of treatment are being adopted and more care is being exercised in the preserving of foods. On the other hand, because of the more general recognition of the cause and effect, the number of cases seems to be increasing. This is only an apparent increase, however, and can but lead to better ultimate results. The medical and even the daily literature are all doing their good work in this respect, in spite of the facts that the reports are only too often sensational and erroneous. A very excellent compilation of the more prominent cases of ptomaine poisoning up to 1895 will be found in Vaughan and Novy's standard work on Ptomaines and Leucomaines. Therefore it will be sufficient in order to establish some of the main facts in connection with the subject to cite a couple of cases from current medical literature, to be followed by two illustrative cases which have come under the personal observation of the writer.

The "British Medical Journal" of Jan. 2d. 1897, reports that a man and his wife on November 22d, ate for dinner and supper part of a rabbit and pork pie, from which they experienced no ill effects. The next day, November 23d, the woman re-heated the pie and had it for her dinner. Her husband and his brother, after a hard day's work, came in for supper and ate what remained of the pie. Through the night all three suffered from vomiting, purging and violent pains in the bowels. The brother, who was a lad of 16 and who had eaten most of the remains of the pie, was so seriously affected that he became delirious. Fortunately, all recovered under proper treatment. The attending physician testifies to the symptoms as being those of ptomaine poisoning.

Another case, and one occuring in this country, may be cited as reported by the "Medical Record." In this instance from 30 to 40 persons were very seriously poisoned in a New England boarding school for young ladies. The trouble was traced to the turkeys eaten for supper, and was at first thought to be due to the fowl having fed on some poisonous plant. But it was learned afterwards that the birds had been shipped from a considerable distance, and had thus developed ptomaines.

As regards the first case coming under our own observation, it occurred some years ago in New York state, not far from Geneva. A camping party of about twenty persons, of both sexes, and of ages ranging from 5 to over 60 years, had established itself on the shore of Seneca Lake, about 18 miles from the above-named city. Supplies were periodically sent to camp, and one evening a large wooden bucket of "pressed veal" was received there and much relished by all for supper. During the night all the campers were affected as though an irritant poison had been administered, and only prompt action by the village doctor prevented serious results. It was at first thought that some poison had accidently been introduced through the spices used or by means of some of the cooking vessels, but this theory was disproved by the fact that the family in Geneva who had prepared the veal, also partook largely of it, without experiencing any bad effects. So there could be no other cause assigned in this case excepting the formation of ptomaines. And in fact, all the conditions for such a development were present. The veal had been prepared the evening before and had been carried 18 miles, fastened between the wheels of the carriage, while the day was a very hot one, and the roads in a very dusty condition.

The Pittsburgh, Pa., papers, towards the latter half of April, 1896, gave full particulars of a wholesale poisoning which was finally found to be due to a ptomaine (tyrotoxicon) developed in the custard of a layer cake. A very startling series of mysterious cases of poisoning were at that time reported by several physicians from that portion

of the city known as the Southside and from Hazlewood. In the latter place 12 persons were poisoned, while at least twenty other cases on the Southside were traced to the same source. All of these were upon investigation found to be caused by a batch of cake sold by one baker, whose family of 4 children was also prostrated by the poison. It was noticeable that two or three days previous to the trouble the weather had been very sultry and hot. All the patients ultimately recovered. The Penn'a Dairy and Food Commissioner, through his deputy, promptly investigated the matter. It was found that the baker's establishment was cleanly and well kept, and that no suspicion could rest upon any of his cooking vessels and other utensils. The proprietor of the establishment, who was greatly worried over the affair, stated that he had prepared the same kind of cake in the same manner for 15 years previous, and did all he could to invite investigation and exonerate himself from blame. Some of the cake was finally placed in the hands of the writer for inspection and analysis. Altogether three samples were submitted to him, all of them being parts of cake which had proved so poisonous. The pieces showed the cakes to have been a chocolate layer cake, with a layer of custard running through the center. On removing the cake from both sides of this layer, the latter was found to be covered here and there with patches of greenish and blackish mould. This appearance led to the suspicion that poison might have developed in the custard by fermentation. Upon proper treatment it furnished a residue which had all the appearance and odor of that belonging to the ptomaine known as tyrotoxicon. Further tests, especially the physiological one of tasting, confirmed the presence of this poison. It caused the characteristic burning and retching sensation in the throat.

It must not be assumed from the cases just given, none of which proved fatal, that the outcome is always so fortunate. The quick recovery in these instances is no doubt due to a better understanding of the poison and the prompt application of the proper antidotes. A large proportion of the previously reported cases terminated fatally, or at least resulted in very slow recovery; thus one effect of a recent food poisoning in England was scepticemia which necessitated amputation above the knee.

A study of the large number of poisonings by various foods will show that hardly any of these containing proteids are free from danger. To mention a few of these recorded we find deleterious effects traced to apparently fresh meats of all kinds, to frozen, smoked and pickeled meats, to domestic and wild fowl, to canned goods of all sorts, to stale eggs, to fish, to oysters, to milk and cream, to koumiss, to ice cream and custards, to decayed non-poisonous mushrooms and many others. Poisoning from mouldy corn meal and wheat bread has also been recorded, and Nansen, the celebrated arctic

explorer, in one of his recent magazine articles even expresses the belief that scurvy, the disease so dreaded by the seafaring man, and especially by him who must pass the winter amid the rigours of an arctic climate, is due to the minute quantities of ptomaines which develop in the preserved meats that figure so extensively in his bill of fare. The very deleterious effects noticeable from eating the flesh of deer and other game that has been driven and worried before death, are also thought to be traceable to ptomaines resulting from the overheated condition of the animal.

The symptoms of ptomaine poisoning are usually well pronounced, and though occasionally mistaken for those produced by vegetable poisons, may, by careful diagnosis, be distinguished from them. The patient is seized either with a rigor, with fainting and muscular weakness, or with abdominal pain. Vomiting may follow, accompanied with giddiness. Or diarrhoea and great thirst are an almost invariable and prominent symptom. The patient then becomes feverish and as the action of the poison progresses, the heart and nervous system are attacked. Great bodily prostration, twitchings, dilation of the pupil and disturbances of vision and drowsiness follow, which may end in death, the victim usually being unconscious. If he recovers, convalescence may be very tedious.

As in the case of any other violent poisons, the object of treatment is to get rid of the poisonous material from the alimentary tract. Of course a physician should be sent for at once, but if there is any danger of delay on his part, a purgative may be given (one ounce castor oil, with 5-10 minims of tincture of opium or 3-5 grains calomel). The diet should be strictly liquid.

The time which may elapse between the eating of the food causing ptomaine poisoning and the appearance of the symptoms, in other words, the period of incubation, may vary considerably. The numerous recorded cases show a range of from 4 to 48 hours. Directly after partaking of the poisonous meal, the patient experiences, as a rule, no bad effects, but once started the disease takes hold very suddenly. This difference in the rapidity and strength of the attack is no doubt due to the condition of the food and the number of bacteria present. If the putrefactive changes have taken place in the food before it is eaten, with the formation of the poisonous chemical substances, the onset will of course be rapid; while if these changes occur only after the swallowing, the symptoms will naturally appear much more slowly. These facts have considerable practical bearing upon the subject, as from the period of incubation the attending physician will be able to judge as to whether he has to do with an introduced poison, or one developed in the system.

One of the most remarkable features of the whole question, is the fact that very frequently no outward indication will be noticed to

warn us of the presence of a poisonous principal in the food in which death may lurk. Nature as a rule protects the individual from danger by giving some sort of warning of its nearness, through the senses. Injurious substances as a rule are indicated to us by our sight, smell or taste, being generally repulsive, bitter or nauseous. Not so here. The poisonous ptomaines appear to be developed usually during the first stages of fermentation and putrifaction, and may be present without being in any way indicated by outward appearance of the food containing them. Nor is odor a criterion, for while sometimes a slight mustiness is noticeable, it is in most cases in no way peculiar. A putrefactive odor would of course serve as a warning. As a rule, likewise, no change in the taste can be detected. It is this fact that should cause us to watch with great care over the source, freshness and condition of our foods, especially those of a nitrogenous nature.

Another noticeable feature, and one that often obscures the question and complicates the tracing of the poison to its source, appears in those cases where the same or apparently the same lot of food has in some instances produced poisoning, while in others it has been inert. Sometimes careful examination will fathom the mystery, as when it was found that some lobster, a part of which proved toxic while the rest was harmless, owed its poisonous effects to being kept in an open can for several days; or as reported in the case of some sausages of which the cortical portions were without action, when the much changed interior produced violent disorders. Much more difficult of explanation is the apparent volatilization or passing away of the poisonous alkaloids during different stages of decompostion. This is well illustrated by the very interesting case as given by Brouardel. Two pork butchers in Lille (France) had purchased a pig, dividing the carcass into equal halves. Curious to say, all the customers of the one sickened after eating sausages made of the flesh of his half, while the customers of the other butcher did not in any instance suffer ill effects. It could not, therefore, be the previous condition of the meat that was to blame, since the shop, the stall and the workshop of the butcher were clean and well kept. Further search thus became necessary. The pig had been killed on a Friday, a day on which pork butchers' shops are closed in Lille. The flesh had been exposed on Saturday, May 19th and Sunday, May 20th, and none of the buyers had suffered at all. Those, however, who bought sausages on Monday and Tuesday, May 21st and 22d, were all taken ill and four of them died. The authorities now interfered and the sausages were placed under quarantine and ordered destroyed. But the butcher not wishing to lose the value of his ware, fed himself and his family upon the condemned sausages and, remarkable as it may seem, they experienced no untoward effects. This peculiar immunity can hardly be accounted for by any theory of idiosyncrasy, but arose

probably from a further stage in the putrefaction of the pork, whereby the poisons first produced were later on destroyed by the action of a new set of different bacteria. In this connection it may be stated that many analogous observations have been made by bacteriologists, who find that the poisons generated by a given bacterium may become too powerful for this bacterium and destroy it, after which new varieties arise.

So many mistaken ideas regarding the ptomaines are still current, even with those who should be well informed regarding the matter, that it may be well to point out a few of these errors. In the first place, the importance of and the ever-present danger of ptomaine poisoning is not always fully realized. Many cases of sudden sickness or mysterious illness are ascribed to other causes, and grave suspicions are often directed towards innocent persons. A very common idea is prevalent that the vanilla used in flavoring ice cream, custards, etc., will at times cause the symptoms of irritant poisoning. Nothing could be more fallacious. No well authenticated case of vanilla poisoning is known, and whenever proper steps are taken to trace all epidemics from vanilla ice cream and other like foods back to their proper source, the presence of ptomaines has become evident.

Another great danger of poisoning is, according to the popular idea, to be found in the use of unclean copper vessels. It may sound strangely, as one writer says, to those who have not given the matter serious attention, to say that copper utensils are not specially dangerous for cooking. For ages this particular metal has been used without markedly detrimental results, and many authorities go so far as to maintain that as yet no well-established cases of copper poisoning from the use of copper or brass vessels, have been recorded. Professor Brouardel, of Paris, states that this idea of poisoning by copper owes its origin to Jean Jacques Rousseau. The latter had very forcible ideas on all matters, and they were very fashionable for awhile and reigned supreme. It is not very wonderful, therefore, that the opinions he professed on the injuriousness of copper should have gained acceptance. Nevertheless it must not be forgotten that the ancients did their cooking in copper vessels. The tinning of copper saucepans was only introduced, into west of Europe at least, by gypsies who were the first to line the interior of copper vessels with tin more or less pure. Lastly, at all times and even to-day, certain culinary preparations are made only in untinned pans. Such is the case with preserves, which have never yet poisoned anybody, and still they are capable, for example, when current jelly is made, of attacking the copper and forming soluble salts of the metal. We know now that copper utensils are quite harmless, so long as they are kept in good order. On the other hand, cases of ptomaine poisoning from tainted food ingredients are quite common. In many of them the presence

of the poisonous alkaloid has been conclusively demonstrated, while no copper was found in the food and ejecta of the patients.

Right here may be mentioned the fact that owing to the similarity of the ptomaines in their reactions to the vegetable alkaloids, many important chemico-legal questions have been noted. For a time this similarity threatened to render the detection of the ordinary vegetable poisons, such as morphine and strychnine, very doubtful, but fortunately this difficulty has, by close study, been overcome and the experienced toxicologist will not be apt to confound the various alkaloids.

A further misconception on the subject of ptomaines is the notion that they are bacteria. We have seen that they are not micro-organisms, but the products of the life of such minute plants. This explains why it is that, contrary to oft-repeated statements, they are not usually destroyed by the heat of ordinary cooking, as they would be if they were living organisms. Even Panum demonstrated that the poisonous principles of decaying flesh are not destroyed by boiling, even for a long time, and later investigations have fully confirmed this, and shown that almost all, and especially the more important ptomaines are extremely stable and resistant against heat. Therefore, there can be no safety in boiling as far as the destruction of these bodies is concerned, and no amount of moist heat is, generally speaking, a preventative. Even the most powerful disinfective fails to destroy the majority of the ptomaines. The only prominent exception to this rule is the tyrotoxicon of Vaughan, which frequently develops in milk, custards and other like substances, and which is fortunately entirely destroyed by ordinary boiling.

Another statement which should be stamped as false, is that by boiling the poison may be dissolved out and so much diluted by the water as to become harmless or even be volatilized. This has been found to be a dangerous idea, because while most of the poisons are soluble in water, they will not, if hidden in the center of a piece of meat, diffuse through the tissues and be dissolved and diluted.

On the other hand, it must not be assumed that all of the ptomaines are poisonous. While some of them are so intensely toxic that an almost infinitesimal amount of them may prove fatal if taken inwardly, others are non-toxic; or, again, others may even under certain conditions become beneficial to the human race. As an instance, we have but to remember the solution of diphtheria anti-toxicon, which is nothing else but a prepared ptomain solution which acts as a poison upon the specific germ of that dread disease.

The prevention of this class of food poisoning is a matter of extreme difficulty. Given the proper conditions, it is liable to arise at any moment, and, without warning, owing to the peculiar property of not usually altering the appearance, odor or taste of the food material in

which it exists. And there can be no doubt that food which has become slightly tainted is frequently used nevertheless, especially by the poorer or careless classes, who from a false idea of economy are led to use what they have bought. The dangers of such wrongly applied frugality cannot be too strongly pointed out to everyone, particularly during the warmer weather. A rigid inspection, especially of the meat, milk, cheese and ice cream supplied, and of the buildings in which they are prepared and sold, should be made as often as practicable, and all suspicious articles confiscated and destroyed. It is true that in many cities the fresh meat and milk supplies are more or less effectively inspected, but this supervision should be extended to other nitrogenous foods. A recent author has gone so far as to suggest that, in view of the many poisonings that have resulted from canned goods, the canneries should be daily inspected during the packing season; and that furthermore it be insisted upon by law that as a safeguard the manufacturer shall label the cans as follows: "The contents of this can are perfectly wholesome when eaten fresh from the tin and afford good food; but the public is advised not to expose the contents for any length of time to the injurious influence of the atmosphere."

In conclusion, let us hope that the good work of investigation and experiment in connection with the ptomaine poisoning from food will go on until we have discovered a simple and ready method of its detection.

Great have been the results of the past fifty years; and the future fifty promise still greater ones. In the meantime, however, we must remain fully alive to the achievements so far attained, and not allow ourselves to pass into a state of inactivity while we may be face to face with death, all the more sorrowful because it is unforeseen and unavoidable.

EXTRACTS FROM EXPERIMENT STATION BULLETINS.

COMPILED BY THE SECRETARY.

SUGAR BEETS IN PENNSYLVANIA.

In Bulletin No. 40 of the Pennsylvania State College Agricultural Experiment Station, Dr. Armsby thus alludes to some of the difficulties which confront the production of beet sugar in Pennsylvania:

"In considering the question of the domestic production of sugar from the beet, a sharp distinction must be made between the two parts of the question. These are, first, the production of the beets and second, the manufacture of sugar from them. The second portion of the problem has been very thoroughly worked out in European countries and is not a question at present needing investigation in this country. The technology of sugar manufacture has been perfected by years of study and experience, and is now very thoroughly understood. It is not an industry which can be carried on on the small scale by the farmer himself, or even in a small factory. The most reliable estimates place the minimum size of a successful beet sugar factory at a capacity of 300 tons of beets per day, and the cost of such a factory is estimated at not less than $200,000. The season during which sugar can be manufactured is comparatively short, being limited by the length of time during which the beets can be preserved, and to secure an adequaté return upon the capital invested requires that the factory shall be run to its full capacity during the season, and that the best technical skill shall be employed to direct its operations. All hope on the part of farmers that they can manufacture beet sugar with simple and inexpensive apparatus should be given up once for all. The question for us now is whether we can raise good sugar beets in sufficient quantity to supply a factory and at a cost which will leave

an adequate profit. The farmer should confine his attention strictly to this side of the question. When he can and will produce the beets, capital will be forthcoming to manufacture the sugar, as has been amply demonstrated in other states.

"Since all sugar beets contain more or less sugar it is necessary, in order to form a judgment as to the meaning of the results obtained, to know what percentage of sugar and what other properties are necessary to render a beet suitable for the manufacture of sugar. In general, the requirements are three.

"1. Size. If the beets are too small, the yield per acre is likely to be light and the profits to the grower little or nothing. On the other hand, if the beets are too large, they are apt to be poor in sugar. General experience has fixed upon the weight of about one to one and one-thirds pounds as the size best suited to secure the interests of both farmer and manufacturer.

"2. Sugar content. While, as stated above, all sugar beets contain some sugar, it has not usually been found practicable to manufacture sugar commercially from beets containing less than 12 per cent.

"3. Purity. By the purity of a sugar beet is meant the proportion which the sugar bears to other soluble ingredients. This is of importance because these other soluble ingredients prevent a portion of the sugar from crystallizing and, therefore, diminish the yield. The purity is expressed by the percentage of sugar compared with that of total soluble matter. Thus, if the juice of a sugar beet contains 14 per cent. of total solid matter in solution and 12 per cent. of sugar, the co-efficient of purity is 12 divided by 14, or 85.72 per cent. The lowest percentage of purity admissible in the beets to be used for manufacturing sugar is usually stated at 80 per cent., although this depends a little upon the absolute richness in sugar."

"The first question which presents itself to the farmer is whether it will pay him to raise sugar beets for sale to a factory. The experiments here reported were made on the small scale and afford no reliable data as to the cost of raising a crop. The figures and estimates as to the cost of raising beets which are given by large growers in other states are quite variable, ranging all the way from $20 to $70 per acre. A conservative estimate, however, is from $30 to $40 per acre, although the cost will naturally depend upon local conditions and especially upon the experience and intelligence of the grower. The general experience in other states has been that the second years' crop has been produced much more cheaply than the first year's.

"The price paid for beets at the factory depends chiefly upon the market price of sugar and upon the richness of the beets, but also upon local conditions. Assuming four dollars as an approximate average price for this country, the profits of the grower will depend largely upon the tonnage of good beets which he is able to produce.

Ten tons per acre seems to be generally regarded as a fair crop, although good land and careful cultivation should produce twelve to fifteen tons. According to these figures, the total value of the crop at the factory would range from $40 to $60 per acre.

"To the above estimates is to be added the feeding value of the diffusion residues, or pulps, from the manufacture of sugar. These constitute a palatable and nutritious food for stock and in all beet-sugar growing countries the keeping of live stock is regarded as an important adjunct to the growing of beets. It is impossible to fix any money value upon these residues, but we are probably safe in assuming them as roughly equivalent in feeding value to half their weight of mangels. It is also estimated by good authorities at from one-fourth to one-fifth of the value of the beets. The molasses, too, which is a by-product of the sugar manufacture has a not inconsiderable feeding value, and the same is true of the leaves and crowns of the beets. Moreover, when these by-products are returned to land there is little or no draft upon its fertility, since pure sugar contains neither nitrogen, phosphoric acid nor potash."

THE REMOVAL OF BACTERIAL TAINTS FROM MILK.

After clearly explaining the difference between the taints which enter milk by absorption and those which are clearly due to bacteriological origin, Prof. Russell, of the Wisconsin Station, thus refers to the removal of such taints as obtain entrance into the milk through the development of bacteria:

"Supposing the taint to be due to some abnormal fermentation, how should it be treated? There are two general methods of treatment that should be followed:

"1. Eradication by eliminating the inciting cause.

"2. Overcoming the difficulty by an antagonistic fermentation.

"Let us assume that the defect is a ropy condition that appears in the night's milk or milk that is held over Sunday. This difficulty is due entirely to the presence in an unusual degree of certain kinds of bacteria that have gained access to the milk in large numbers. In ordinary milks the slime forming organisms can often be isolated. In three separate instances during the past season, in the writer's laboratory, micro-organisms of this class have been found in normal milk. It is only because this particular kind was not in the ascendancy that

the milk did not undergo slimy degeneration under ordinary conditions. Such forms exist in water, soil and filth of various kinds, but few of this type get into the milk compared with the total number there present. If, however, a mass of them should be accidentally introduced and they should gain the mastery over the more common sour milk bacteria, the milk would soon assume a slimy or stringy condition. The various fermentations that are continually going on in milk represent, in a limited compass, the perpetual struggle that is seen everywhere in nature. In many cases different forms live together in the same fluid in seeming harmony, but only so because both of them are indifferent to each other. If the food elements that are necessary to their existence are the same, sooner or later a struggle ensues as to which will gain the mastery, and just as the weaker plant or tree is choked out in the field or forest, so the course of fermentative changes is determined by the predominance of certain ferment germs and the conditions that affect their environment.

"Having determined that the abnormal condition is a slimy fermentation that is general to the whole herd, the question is to locate its origin. Under ordinary conditions it must gain a foothold in the milk subsequent to its withdrawal.

"In some instances where inflammation of the udder (mammitis) occurs, the milk is slimy when it is drawn, but such instances would be readily recognized from the condition of the udder. The most likely sources of infection of this character are those that are due to the contamination from the barn air or the animal herself. Brushing and carding the under parts of the animal to remove loose hairs and then thoroughly moistening the same to prevent the dislodgement of fine, dust-like particles will materially diminish the danger arising from the coat of the animal. Cows wading in stagnant pools often become coated with slime, and in some cases slime forming bacteria have been found on the surface water.

"The fault may be with imperfectly cleaned utensils, such as rusty cans or pails. Such a source of infection may be positively excluded by giving all utensils, strainers and dippers, as well as cans and pails, a thorough scalding and steaming. Epidemics of these milk troubles have been in several instances traced to contamination of barn air from foul feed or litter. The dust arising from such coarse stuff remains suspended in the air for some little time and under such conditions exposure of the milk may result in infecting it with the obnoxious form."

MAINTAINING FERTILITY.

The Ohio Agricultural Station, in Bulletin No. 80, after a careful series of experiments in the maintenance of fertility, draws the following conclusions:

"On the clay soils, which have been under test in most of these experiments, phosphoric acid seems to have been the most effective constituent of a fertilizer for cereal crops and clover grown in rotation, but the full effect of the phosphoric acid was not attained until both potash and nitrogen were added.

"It appears, however, that the quantities of potash and nitrogen actually used in most of these mixtures were greater than was required for the full utilization of the phosphoric acid, and that the most effective fertilizer, in proportion to cost, would be one containing nitrogen and potash in approximately equal quantities, with phosphoric acid largely in excess.

"In the continuous culture of cereals nitrogen appears to be the most important constituent of the fertilizer, but, as in rotative cropping, it is the complete fertilizer, containing phosphoric acid and potash as well as nitrogen, which produces the maximum effect.

"Potash seems to have a relatively greater effect on the sandy land employed in one of the tests than on the clay, but further investigation on this point is needed.

"At the price at which 'ammonia,' phosphoric acid and potash are sold in the fertilizer markets of Ohio, the cost of the fertilizer has been greater than any increase produced from it in crops grown continuously on the same land in these experiments. When the cereals have been grown in rotation with clover, the cost of the fertilizer has been recovered, with a margin to spare, provided nitrogen and potash were used in small proportion relatively to phosphoric acid; and when potatoes formed one crop in a three-year rotation with wheat and clover, it has been comparatively easy to secure a profit on the fertilizer.

"In rotative cropping, ordinary barnyard manure has produced increase to the value of a dollar to a dollar and a half for each ton of manure, this increase being found chiefly in the hay crops, whereas the increase from chemical or slaughter-house fertilizers is shown chiefly in the grain crops.

"The nitrogen, phosphoric acid and potash in wheat bran and linseed oil meal seem to be nearly or quite as effective in producing increase of crop as the same constituents in the ordinary mixed fertilizers of commerce. Since the larger portion of these constituents

passes into the manure in feeding, the inference is justified that, by proper care of the manure, a large portion—probably the larger portion—of the cost of these valuable feeding stuffs may be recovered in the manure.

"A ton of clover hay carries fertilizing constituents to the value of more than eight dollars, as compared with the prices at which mixed fertilizers are sold in Ohio, and assuming that these constituents are equally available with those in mixed fertilizers. It is probable that they are not quite so quickly available, but the apparent fact that commercial fertilizers can be used with profit in the production of cereals only when these cereals are grown in rotation with clover, and the high value as fertilizers which bran and oil meal are shown to have, all combined, most forcibly indicate that through the feeding of live stock, the careful saving of the resultant manure, and its intelligent employment in a scientific rotation of crops, lies to-day, as of old, the road to economical maintenance of fertility."

DIFFERENCE BETWEEN GOOD AND POOR COWS.

Farmers' Bulletin No. 56, of the United States Department of Agriculture, thus refers to the great difference in profit and value between good and poor cows:

"The ability to utilize food profitably and convert it into milk and butter is an individual characteristic, in which there is an immense variation among cows.

"The difference in the profits from keeping good, medium and poor cows has been strikingly illustrated by the experiment stations in their herd records and in various feeding experiments.

"Thus, a bulletin of the Utah station, giving the record of 15 cows for one year, shows that the cost of the food eaten for each 100 pounds of milk produced varied with different cows from 29.48 to 52.07 cents. The cost of food per pound of butter ranged from 5.91 cents to 11.8 cents in the case of different cows, and with butter at 20 cents a pound, the net profit from a cow for one year ranged all the way from $14.71 to $51.37. The cows were common natives and grades, selected with considerable care.

"A recent experiment at the Pennsylvania station touches on this point. Nine cows, mostly Jerseys and grade Guernseys, were fed in an experiment lasting 150 days. The difference between the profit from the best cow and the poorest cow during 150 days was $33.10.

The cost of the food was very nearly as much for the poorest as for the best cow, but the value of the product from the best cow was $64.32, while that from the poorest cow was only $28.06. This gave a net profit of $37.65 from the best cow, and only $4.55 from the poorest cow.

"These figures emphasize the importance of keeping a record of the different cows of the herd, so as to know which of the cows are being kept at a good profit and which are only barely paying their keeping, and thus be able to weed out the unprofitable stock and improve the herd."

COST OF SPRAYING APPLE TREES.

In Bulletin No. 51, of the Agricultural Experiment Station of Nebraska, Messrs. Youngers & Co. give the cost of spraying their orchard of 1,008 trees, planted in 1886, 1887 and 1888, to destroy the codling moth, as follows:

"We commenced our first spraying Monday, May 17, and finished Thursday May 20. The blossoms had fallen on all varieties except the Jenet, on which there were still a few scattered blossoms. We used one-fourth pound of London purple to each kerosene barrel of water—52 to 55 gallons. The cost of the first spraying was as follows:

Two men and team, 3 days, at $3.50, ...	$10 50
London purple, ...	1 15
Total cost of first spraying, ...	$11 65

The second spraying was commenced June 2 and completed June 4, the entire ground being covered in twenty-three hours. The shorter time consumed in the second spraying was due to the fact that the men were more familiar with the work. The cost of the second spraying was as follows:

Two men and team, 23 hours, at 35 cents, ...	$8 05
London purple, ...	1 15
Total cost of second spraying, ...	$9 20

This brings the total cost of both sprayings to only $20.85, a fraction over two cents per tree.

In spraying, we used four kerosene barrels, having the pump so arranged that we could change it from one to the other very quickly. In that way we could fill all the barrels at the tank at once and very little time was lost.

On 360 of the trees we added Bordeaux mixture to the solution of London purple, using four pounds sulphate of copper and five pounds of lime to each barrel of water. We were well pleased with the results, as the leaves were large and the general appearance of the trees much better than those not so treated. We could see no difference in the fruit, as everything except the early varieties was more or less wormy. Still, an orchard containing about forty trees on the same quarter section, owned by ourselves, which was sprayed but once, showed a decided difference in favor of the second spraying. While the orchards contained the same varieties, Wine Sap and Ben Davis, the orchard that was sprayed but once dropped its fruit before maturity, nothing being saved for winter use, while the orchard that was sprayed twice carried its fruit much better and matured some splendid specimens. In packing fruit for the Trans-Mississippi Exposition we selected Ben Davis, Wine Sap and Missouri Pippin, of which 267 apples filled a three-bushel barrel. Our Wine Sap packed for the exposition contained 300 apples to the barrel.

We believe that if we had continued spraying two or three times more, the results would have been much better. We are convinced that the different broods must be fought as they appear. Our early apples, with two sprayings, were almost perfect, and up to August 1st it appeared as though all of the winter varieties were going to escape, but in our opinion the damage was done during the month of July. At any rate, we will try at least four sprayings, and perhaps five, the coming season."

After commenting upon the report of Messrs. Youngers & Co., Prof. Card advises as follows:

1. Spray with Paris green as generally recommended, about one week after the blossoms fall, or in time to get the calyx cups well filled with the poison so that they may close over and hold it there.

2. Spray again with Paris green and Bordeaux mixture combined, or with kerosene emulsion, about June 1, or better still, observe carefully and apply this when the eggs are being laid in abundance on the leaves, which at Lincoln occurs at about this date. Laboratory experiments indicate that kerosene emulsion will be more effective than Paris green at this time.

3. Scrape the bark and place paper bands around the tree about the last of June, when the larvae are beginning to leave the apple to pupate. Examine these two or three times, a week apart, and destroy the insects found beneath them.

4. If these methods are not wholly effective, owing to the proximity of neglected orchards, or from an unusual abundance of moths, later

spraying, with either Paris green and Bordeaux mixture or kerosene emulsion, may do some good, but apparently cannot be expected to be wholly effective. Late spraying with arsenites is much more likely to injure the foliage than earlier applications, and if the other methods are thoroughly followed, it will probably be unnecessary.

5. If larvae are still found in the apples in any considerable numbers towards the end of the season, place paper bands about the tree about September 1, or a little earlier. Leave them there until the fruit is gathered from the orchard, then remove, and destroy the larvae hibernating beneath them.

6. Screens placed over the windows and doors of the cellar or rooms where apples have been stored, will prevent those larvae which are taken in with the apples from escaping as moths in the spring.

GLUTEN FEED AND GLUTEN MEAL.

The Michigan Experiment Station (Bulletin No. 149), thus refers to these feeds which, within the past six years, have become quite well known to Pennsylvania dairymen:

"Several tons of gluten meal have been fed at the station, and since the feeding stuff is comparatively new to the state, a reference to its value and place in the ration is here made. These gluten feeds are the residue from the manufacture of either glucose or starch, and differ in composition, according to the method of manufacture and to the thoroughness with which the starch is extracted in the process. These methods of manufacture differ very materially in their results, but they consist essentially in the separation of the outer coating of the kernel and the germ from the interior starchy portion. This is done by machinery and by soaking the crushed kernels in water. In the process the germ may or may not be separated from the gluten and the skin. The gluten in the kernel resides in the layer of cells immediately beneath the skin. If the corn is yellow these gluten cells are yellow. They are characterized by a high content of both protein and fat. The germ occupies the point of the kernel, from which the sprout comes as the kernel germinates. It is rich in oil and gluten."

Prof. E. B. Voorhees, of the New Jersey Experiment Station, reports in Bulletin No. 105, of that station, page 7, the analyses of the kernel of corn, of the skin, of the germ and of the starchy and hard parts, in the following table:

Station number.		Amounts secured from 100 parts of original corn.	Per cent. of water.	Fat.	Crude fibre.	Protein.	Ash.	Carbohydrates.	Nitrogen.	Phosphoric acid.	Potash.
905	Original number, ..	100.00	24.74	4.84	2.02	12.65	1.73	79.26	2.02	.83	0.47
906	Skin, ...	5.56	15.29	1.59	16.45	6.60	1.27	75.36	1.06	.23	0.38
907	Germ, ...	10.17	29.62	29.62	2.88	21.71	11.13	45.79	3.48	6.16	2.91
909	Starchy and hard parts	84.27	24.66	1.54	.65	12.23	.68	85.58	1.96	.35	0.17

"The germ, although only about 10 per cent. of the whole kernel, contains 65 per cent. of the fat, 61.5 per cent. of the mineral matter, 71 per cent. of the phosphoric acid, 60 per cent. of the potash and 16.33 per cent. of the nitrogen or protein. The remaining portions are characterized, the skin by the content of fiber, 51 per cent. of the whole, and the starchy parts by the carbohydrates, of which it contains nearly 90 per cent. of that in the whole grain."

"It is evident from these analyses that the composition of the by-products made from corn depends on whether more or less of either the germ, the skin or the starch is left in them. If the starch alone is removed the trade name of the product is gluten feed. The germ ground alone is called germ meal. The gluten cells alone or with the germ is called gluten meal. These names are used, however, indiscriminately, and it is quite impossible to gather any correct idea of the composition of these by-products from the names alone. The gluten meal should be richer in protein than the gluten feeds. Below are given the analyses of gluten feeds and gluten meals, taken from the Bulletin 105 of the New Jersey Station, to which reference has been made:

Name.	Pounds per hundred of—					
	Water.	Crude fat.	Crude fibre.	Crude protein.	Crude ash.	Carbohydrates.
Chicago gluten feed, ...	7.61	14.18	6.81	24.08	0.87	47.00
Peoria gluten feed, ...	6.94	14.84	7.11	22.64	0.97	47.50
Buffalo gluten feed, ...	10.20	13.67	7.17	22.65	0.84	45.47
Average of seven samples, ...	8.32	12.74	6.84	21.61	0.86	49.63
Cream gluten meal, ...	7.37	15.64	1.45	41.76	1.58	32.20
King gluten meal, ...	9.86	19.77	1.47	35.09	1.90	32.41
Iowa golden gluten meal, ...	7.61	12.65	3.60	30.47	1.00	44.67
Average of five samples, ...	8.15	14.06	1.66	32.83	1.31	41.99
Av. of three samples Chicago gluten meal,..	9.49	5.56	1.50	35.79	0.86	46.80

These analyses show how valuable in composition these by-products are, and dairymen should exercise due caution in their purchase for that reason. At the prices at which they are usually sold the gluten meals furnish protein fully as cheaply as does any other by-product. Cows, while not exhibiting an especial fondness for gluten meal, have seldom refused it when mixed with other feeds. At the college dairy barn it has been fed in amounts as high as four pounds per day, with good results.

For two successive winters experiments were conducted to test the influence of gluten meal on the quality of the butter. It was found, as an invariable result, that the gluten meal made the butter softer and made it difficult to so churn the cream as to extract all of the butter from the buttermilk. The per cent. of fat in the buttermilk invariably increased from .1 per cent. to .25 per cent., or even .5 per cent. when gluten meal was fed."

SPRAYING APPLES.

Bulletin No. 119, of the New Jersey Experiment Station, gives the following practical advice as to spraying apples to prevent loss from the codling moth:

"The larva of the codling moth, the common worm in the apple, occurs all over the state, and, where active measures are not taken, reduces the values of the crop more than one-half each year, and often makes it entirely unsalable. The moth lays its eggs upon the young fruit, but the caterpillar always enters at the blossom end; spraying must, therefore, be done at the time when the poison may find lodgement there, while it is expanded and while the fruit is still pointing upward.

As a general rule, the first spraying should be done when all of the blossoms have fallen from the trees, and when the apples have set. A second spraying should be made in about one week or, if the weather has been dry, say ten days later, which will ordinarily be sufficient; should it rain after either spraying, the work should be at once repeated. The spraying must be thoroughly done, since unless each of the apples to be protected is covered with the fine spray, the result will be more or less imperfect. Paris green or London purple may be used for spraying at the rate of one pound in 150 gallons of water and, as a measure of precaution, the same weight of quicklime should be added. If arsenate of lead is employed, which is also effective, it

should be used at the rate of one pound in 100 gallons of water. There is no danger of injuring the foliage with the material, and it is just as effective as either of the others.

"Any other larva or insects feeding upon the leaves, like the red-necked, or the tent caterpiller, or the web worm, can be easily reached and destroyed by spraying with these arsenate whenever they are noticed."

In referring to preventing loss from borers, the same authority has the following:

"To prevent the entrance of the borers, which are sometimes troublesome, cover the lower part of the trunk, extending from a little below the ground to eighteen inches above it, with wire mosquito netting, wrapped so as to leave about one-half an inch of space between the netting and the trunk of the tree, tied tightly at the top so as to prevent the insects getting between it and the bark. This netting will usually last two or three seasons without renewal, but may be retied each spring. Tarred paper closely tied to the trunk will answer the same purpose, but in all cases wherever it is used, it must extend a little distance below the ground, so that the insect cannot get beneath it."

CAUTIONS AS TO BEET SUGAR PRODUCTION.

Prof. W. H. Jordan, director of the New York Experiment Station, gives the farmers of New York the following words of caution as to the production of beet sugar as a crop:

"In the first place the sugar beet is a highly bred plant, sensitive so far as content of sugar is concerned, to the conditions under which it is grown. The farmers who cultivate it successfully must be those who are willing to adhere faithfully to definite, careful methods. This does not mean that a minority of our farmers will not succeed, but that the average results are almost sure for a time to be disappointing, and it is the average results which will determine the success of the business when broadly considered. Beet sugar factories cannot be maintained unless the average experience of the farmers in the growth of this crop is satisfactory.

"We are greatly elated over the high percentages of sugar which have been found in New York beets this season, but we must bear in mind that high quality and a large production, as some regard production, are not consistent.

"Some samples which have been sent to this station for analysis have been accompanied by a statement that the crop of beets produced was at the rate of thirty tons per acre. It is probable, either that the method of estimating these crops was not a safe one, or that the beets were not properly grown. Erroneous and greatly excessive figures are very likely to result from computations based upon the theoretical possibility of growing a certain number of a certain size of beets per acre, or from the weight of a short section of a row of beets. Nothing short of the weighing of the entire actual product from a fairly extensive area will give safe figures.

"The yield this year on the station farm from a two-acre field was at the rate of sixteen and a quarter tons per acre, which quantity, after cutting off the top of the beet in the manner required at the factory, and making due allowance for dirt, was considerably reduced. This field of beets was some of the best land the experiment station farm contains, and was given thorough cultivation and the best of care. The sugar content in this crop was very satisfactory.

It is significant that during the past five years the average production in Belgium, and also in Germany, has varied from about eleven to approximately thirteen and a half tons per acre. To be sure these are averages, and while averages are not measures of what the best farmers may do, they are the standards by which as before stated, the success of a business man be gauged. We should not expect the American farmer to do much better than the European farmer, where this industry has for a long time existed, especially at first. New York farmers, if they enter upon the production of sugar beets, will have occasion to congratulate themselves, if, for the first two or three years they reach an average of twelve tons of high grade product per acre. This is not necessarily a condemnation of the business.

We must remember still further that it is necessary for the farmer and the manufacturer to be mutually prosperous, and there certainly are some facts which seem to warrant careful consideration, by the farmer, of the manufacturer's side of the business.

"There is great danger that much of the capital which is likely to be invested in this new enterprise will be inefficiently directed. The manufacture of beet sugar is something with which eastern business men have had no experience, and no careful study of means and methods will take the place of the knowledge which comes from experience. Disasters to capital which may cause losses to farmers are to be feared. It behooves business men, therefore, to proceed with the erection of beet-sugar factories with great caution and only after the most exhaustive study of the problems involved.

"Doubtless farmers will be invited to invest in beet-sugar factory stock. They will be told not only that the stock will be profitable, but also that it is their duty to share in the risks. They should be

very careful in this matter. If the professional boomer appears among them, they should give him a wide berth. He may be resourceful in plausible argument, and it may be hard to resist the fascination of his apparently sound reasoning; but unless the farmers resist his appeals, history will repeat itself, and shares of worthless stock will be very widely distributed among those who cannot afford to suffer the loss. This does not mean that under certain other conditions farmers may not wisely own a share of the factory. If local business men of unquestioned integrity and sound business judgment take the lead in the new enterprise—men who, as the directors of banks and other financial organizations have won the confidence of the community by their successful and honorable methods—then perhaps the farmer may as safely entrust his money to them in this enterprise as in some others."

PLOWING AND MOISTURE.

Prof. Clinton, of the Cornell Experiment Station, in referring to the effects of plowing upon moisture in the soil, writes thus:

"As already indicated, the first step in the preservation of moisture must be the preparation of the soil so that the rain will sink down and not be carried off by surface drainage. In many sections of the country, and especially in the southern states, the great bane of agriculture is the surface washing of the soil. Owing to shallow plowing and shallow culture, the water is unable to sink into the hard soil with sufficient rapidity and is carried along the surface, producing those gullies which are so destructive to farm lands.

"The improvements in the plow have done much towards remedying these defects, but there is still a large amount of ignorance as to the proper use of this implement; as an implement to be used in the preparation of the soil for the reception of moisture, it stands preeminent. Good plowing does not consist—as ordinarily supposed—in merely inverting a portion of the earth, but in pulverizing and fining it and burying the sod or refuse which may be on the surface. The amount of water which a soil is capable of holding depends directly upon the fineness of its particles. Then that plow which will break and pulverize the soil most thoroughly is the one best adapted to fit the soil for holding moisture. This point is well illustrated by King in his book on 'The Soil.' He says, 'Since each independent soil grain of a moist soil is more or less completely surrounded by a film of water, it is evident that, other conditions being present, the largest aggregate surface area may retain the most water per cubic foot.

Now, a cubic foot of marble one inch in diameter possesses an aggregate surface of 27.7 square feet, while if the marble were reduced in diameter to one-thousandth of an inch, then the total area per cubic foot is increased to 37,700 square feet.' From this it is evident that the total amount of water capable of being absorbed by a soil which is cloddy and lumpy is very slight in comparison with what it would be were it in a finely divided state; and not only is its absorbing power less, but its power of holding moisture is also greatly reduced. King found the rate of percolation from soils of different degrees of fineness to be as follows, the column of soil being eight feet in height:

TIME OF PERCOLATION.

Size of grains.	Per cent. lost in 1 hour.	Per cent. lost in 2 hours.	Per cent. lost in 24 hours.	Per cent. lost in 48 hours.
.186 inch,	9.10	10.45	13.05	13.52
.073 inch,	7.95	9.47	12.31	12.72
.061 inch,	6.22	9.21	11.71	11.53
.045 inch,	1.76	2.83	7.64	8.44
.032 inch,	1.23	1.91	5.83	6.79

"This striking difference in the rate of percolation from soils of different degrees of fineness shows most forcibly the importance of thorough pulverization of soils to increase their water absorbing and moisture holding capacity.

"A large amount of water is lost during the winter and spring months owing to the surface drainage of melting snows and heavy rainfalls. To prevent this loss, fall plowing should be extensively practiced, and where the sub-soil is very hard and compact the use of the sub-soil plow may prove most beneficial. Should the ground break up in clods, then it may be allowed to remain during the winter without harrowing, to more thoroughly subject it to the beneficial action of the elements. But should the soil be in good mechanical condition, then some plants should be kept growing on it during the winter. The importance of keeping growing plants on the soil can hardly be over-estimated. They serve to bind the soil, to take up the plant food which may be soluble and liable to loss by drainage. If these plants are plowed under in the spring, organic matter is added to the soil. In corn fields, wheat or rye may be drilled in without plowing, and it will obtain sufficient growth to act most beneficially upon the soil during the winter, and it may be plowed under in the spring, having served its purpose as a soil protector."

RATIONS FOR DAIRY COWS.

Bulletin No. 149 of the Michigan Station treats of dairy rations from a Michigan standpoint, but there is so much of the result that applies as well to Pennsylvania that our dairymen may learn much from the experiments.

After a condensed account of various experiments to obtain an answer as to what ration the average dairy cow needs, the report states that after numerous experiments carefully made, their cows give the following answer:

"A thousand-pound cow, in the fourth month after calving, while yielding on an average 1.21 pounds of fat daily, requires 23.57 pounds of dry matter, 2.06 pounds of digestible protein, 12.50 pounds of digestible carbohydrates and 0.89 pounds of digestible fat."

In referring to the formation and calculation of rations, the bulletin has the following:

"Every reader of the bulletin, however, who keeps dairy cows should make an inventory of the fodders and grains he has on hand, and of such materials as he can purchase in the market, should set down the market price of the latter and the selling price of the former, and, with the data, should compute several rations, adopting the one giving the greatest efficiency at the least cost. Experience must teach the peculiarities of each feeding stuff. In the dairy literature he will find recorded the results of experiments with nearly, if not quite, every feeding stuff on the list. Of this information, he should avail himself and should modify his adopted ration accordingly. It may be that his cheapest ration is not available because some one component is illy adapted to the production of milk for the purpose he wants it. When fed, the ration may produce too soft butter, or too hard, or it may be that while the calculated amount of dry matter, protein and other constituents, is theoretically correct, the combination is distasteful to the cow or does not keep her bowels in their normal condition. All of these factors must be considered and given due weight in practical dairy feeding. With all the information he can obtain from bulletins or other sources, and with all the experience obtained from feeding good and poor cows through many years, it is, after all, that indefinable something that we call judgment that determines the adaptability of the ration and the production of profit from feeding cows.

"With the materials in our supposed case, the following combinations are suggested:

Ration 5.

"Forty pounds of silage, 10 pounds timothy hay, 5 pounds of pea meal, 4 pounds of gluten meal; this ration gives the results as under:

Dry matter,	24.99 pounds.
Protein,	2.29 pounds.
Carbohydrates,	13.47 pounds.
Fat,	.83 pounds.
Cost,	$0.164

Ration 6.

If 15 pounds of clover hay be substituted in this ration for the 10 pounds of timothy hay and 4 pounds of gluten meal, the results will be

Dry matter,	25.58 pounds.
Protein,	2.23 pounds.
Carbohydrates,	12.66 pounds.
Fat,	.523 pounds.
Cost,	$.135.

A ration nearly as efficient and three cents per day cheaper.

Still other combinations, without silage as a basis, are suggested.

Ration 7.

Corn stalks, 8 pounds; clover hay, 10 pounds; corn meal, 4 pounds; wheat bran, 10 pounds, containing

Dry matter,	25.52 pounds.
Protein,	2.35 pounds.
Carbohydrates,	13.22 pounds.
Fat,	.63 pounds.
Cost,	$0.1036

A ration rather high in dry matter, but very cheap and worth trying.

Ration 8.

Or, cornstalks, 10 pounds; clover hay, 8 pounds; corn meal, 4 pounds; wheat bran, 10 pounds, containing

Dry matter,	25.02 pounds.
Protein,	2.26 pounds.
Carbohydrates,	13.23 pounds.
Fat,	.61 pounds.
Cost,	$0.10.

"As far as indicated by the chemical composition of the feeding stuffs and the mathematical calculations based thereon, the rations to be used with feeding stuffs at the prices named will be made up of clover hay, millet hay, silage, roots, cornstalks, corn meal, wheat

bran and oats and gluten meal. The wheat and timothy hay would be sold, and of the feeding stuffs in the market wheat bran, gluten meal, malt sprouts, linseed meal, or cotton seed meal would be purchased, the choice depending on the amounts of the different coarse fodders on hand.

"If the supply of clover hay was sufficient, bran would be the by-product to be bought, but if it is necessary to feed up a considerable quantity of cornstalks and millet hay, cotton seed meal, gluten meal or linseed meal in the order named would be chosen because they furnish the needed protein cheaply. Cotton seed meal cannot be fed in larger amounts than two pounds per day per cow, a fact to be remembered in calculating the amount of protein to be derived from it.

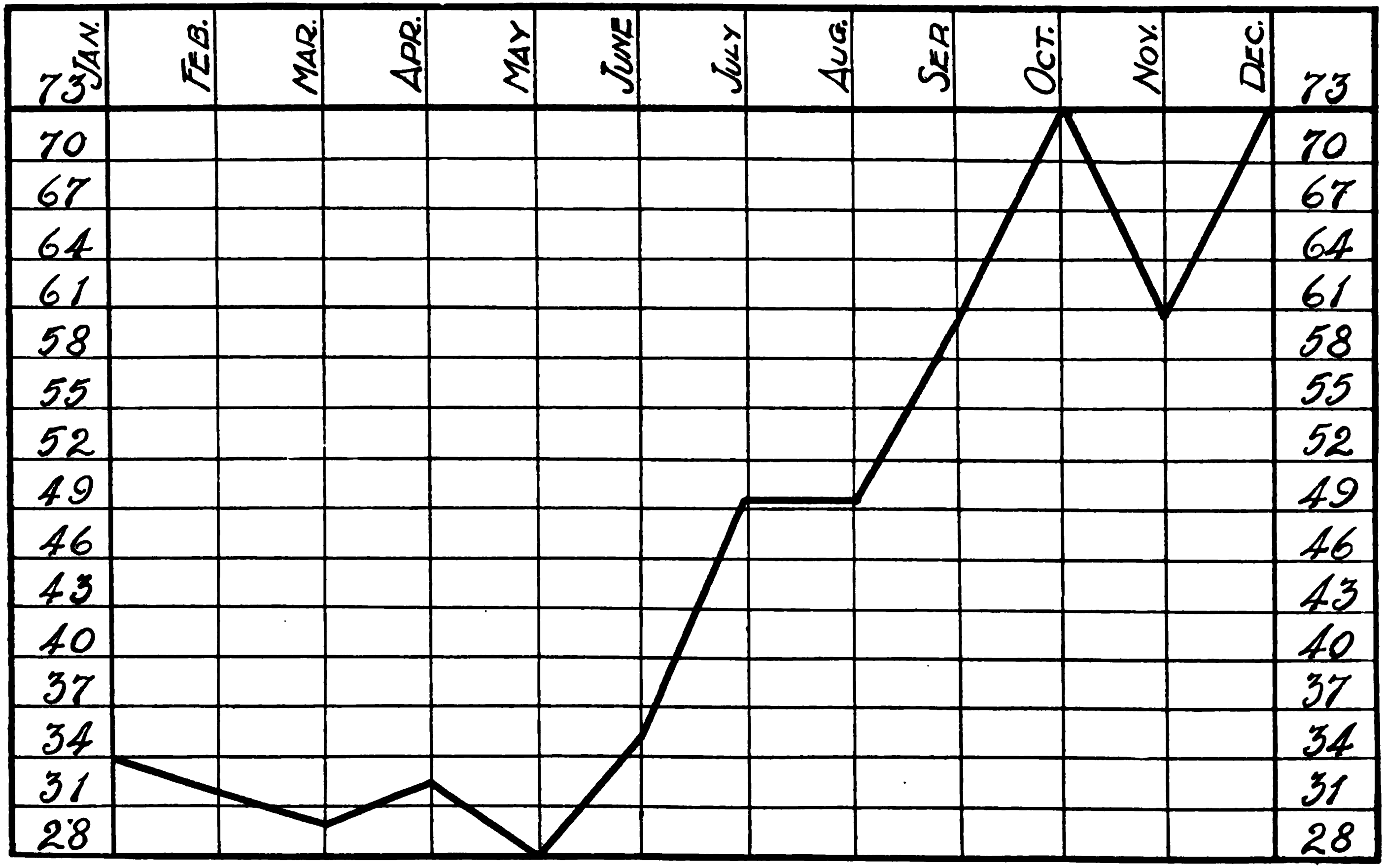
But rations cannot be built up on mathematical rules alone. The peculiarities of the different cows, the milk yield, the lapse of the period of lactation must all be considered. The rules and methods here given are but helps to the experienced feeder. They are not to take the place of judgment and experience, but to aid them. Cattle feeding cannot be relegated to the realm of applied mathematics nor can the tyro succeed as a cow feeder by studying chemical formulae and rules of computing rations. Given, however, a thoughtful and experienced feeder, he can, by studying the composition of feeding materials, learn how to combine them to keep up the production of his herd at less cost and by reducing the cost, increase the profit."

POINTERS IN POTATO CULTURE.

Bulletin No. 130, of the Cornell Experiment Station, gives its readers numerous important points in potato culture, from which we condense the following:

In an experiment the plots having uneven numbers were given thirteen cultivations, while those with even numbers received but nine; as a result, it is stated that the average crop from the thirteen cultivations was 337.5 bushels, while than from the plots receiving but nine was 367.5 bushels.

In 1896 a similar experiment gave as results the apparent fact that the plots receiving eleven cultivations yielded at the rate of 335.9 bushels; those having seven cultivations gave a yield of 343.1 bushels, while those receiving but three workings gave but 275.2 bushels, and an acre which had received six cultivations gave a crop of 330.7 bushels.



PRICES OF POTATOES AT PHILADELPHIA, 1897.

The analyses (average) of 49 samples of soil gave the following amounts of each manurial ingredient, in soil taken to the depth of eight inches:

Phosphoric acid, ...	4.219 pounds.
Nitrogen, ...	3.053 pounds.
Potash, ...	16.317 pounds.

From the same analyses it was estimated that a single acre of soil, one foot deep, amounted to 4.008.8 pounds of phosphoric acid and 11.329.8 pounds of potash.

The Bulletin states: "It will thus be seen that with a soil containing little more than half the amount of potential plant food ordinarily contained in soils, a yield was secured from three to four times the average of the state."

The character of the soil is thus explained: "The fact has been mentioned that this soil was gravelly. In securing a sample for analysis we found in the surface foot 56.79 per cent. of material fine enough to go through a sieve of eighteen meshes to the inch, and 41.85 per cent. of gravel which would not pass through the sieve. The loss due to drying and waste was 1.36 per cent."

The results of the experiments are thus summarized:

1. That the most arable soils possess sufficient potential plant food for a bountiful crop.

2. That the average yield for the state is not more than about one-third of what it should be and what it would be were proper methods of cultivation practiced.

3. The low average in the state is due not so much to a lack of potential plant food as to insufficient supply of moisture.

4. That by frequent surface tillage, moisture may be conserved and potential plant food made available.

5. Commercial fertilizers should only be used when the soil fails to respond satisfactorily to tillage, or to supplement manures and clover crops and stores of plant food already in the soil.

6. Level culture is preferable to ridge or hill culture for conserving moisture. Ridges should only be used when the object is to relieve the soil of moisture as in low, damp fields.

7. All other requisites being present to insure a satisfactory crop, full success cannot be secured unless the foliage be kept healthy and intact.

CREAM RIPENERS.

The agents of the Department of Agriculture have, more than during any previous year, been brought in contact with the use of cream ripeners in the manufacture of butter; if the information received is correct, the manipulators of "boiled." or "process," butter make use of "Conn's No. 41" to impart a "June flavor" to their product. "Cream ripeners" containing a large proportion of cotton seed oil, which, when added to the butter, increases its weight very materially, have also been met with and those using it compelled to appear before the proper officers for the punishment of butter and other adulterations.

The Connecticut Experiment Station, Bulletin No. 16, draws the following inferences from the use of bacteriological cream ripeners:

"1. The cream in ordinary creameries or in ordinary dairies always contains bacteria, a large majority of which are perfectly wholesome, and some give rise either to good flavor and aroma in the butter, or at least produces no injurious effect upon the cream. They are perfectly consistent with the production of the best quality of butter.

"2. In the months of May and June the variety and number of these types of bacteria are decidedly greater than in winter months, and this probably explains in part the better quality of butter at these seasons.

"3. Occasionally a dairy or a creamery may be impregnated with a species of bacteria that grows rapidly and produces a deleterious effect upon the butter. This will produce in all cases a falling off in the quality. The trouble may be due perhaps to a single cow, inasmuch as the milk of individual cows may sometimes contain certain species of organisms not found in others, even in the same barn. It is, however, commonly impossible for the farmer or buttermaker to find the source of such impurities in bacteria.

"4. Creameries and dairies will, in many cases, be supplied with bacteria, giving rise to desirable flavors, aromas and a proper amount of acid. This is commonly the case from the fact that the good flavoring species are abundant, but it will not always be the case. It is more common in June than at any other season of the year, simply because the variety of bacteria is greater at this time, and, hence, the greater likelihood that some species which produce the proper aroma and flavor will be present. Probably also some of the desirable species are especially abundant in the green foods of cows in June.

"5. If cream be inoculated with a large culture of some particular kind of bacteria, this species will frequently develop so rapidly as

to check the growth of the other bacteria present, and thus, perhaps, prevent them from producing their natural effects. Hence it will follow that the use of starters will commonly give rise to favorable results, even though the cream is already somewhat impregnated with other species of bacteria before the inoculation with the artificial starter. This fact lies at the base of the use of artificial starters, either with or without pasteurization. To produce the desirable result, it is necessary to have the starter contain a large abundance of some favorable species which by its growth can both check the development of the ordinary cream bacteria, and can develop a proper flavor by itself."

MANAGEMENT OF APPLE ORCHARDS.

Bulletin No. 119 of the New Jersey Experiment Station, gives the following summarized general advice as to the treatment and care of an apple orchard:

"1. Select soil that is well drained, of good texture and overlaying a sub-soil not too compact.

"2. Choose a few varieties rather than a large number. The situation in reference to markets should guide as to the proportion in the orchard of summer, fall and winter sorts.

"3. Though the fall is the preferable season for setting the orchard, this point is not so important as the selection of the tree, the preparation of the soil and the method of planting. The distance apart of the trees may range from 30 to 45 feet, depending upon character of the soil and the habits of growth of the varieties set.

"4. The main object in trimming is to make a well-proportioned top, which shall admit the sun to every portion. If trees are started right in this respect, trimming consists largely in the annual removal of superfluous growths, which may be performed at any convenient time.

"5. The cultivation of orchards is important, though not a necessity under all conditions. The chief objects to be attained are to conserve moisture, and to increase the available food for use of the tree. If practiced, it should begin with the setting of the tree and be performed with a tool which thoroughly stirs the surface of the soil.

"6. Bearing orchards, even though located on soils in a good state of fertility, should be manured or fertilized; the mineral constituents,

phosphoric acid and potash, are especially useful. A mixture of equal parts of ground bone, acid phosphate and muriate of potash, or one of one and one-half parts of ground bone and one of muriate of potash, furnishes these constituents in good forms and proportions. The amount of the mixture applied annually may range from 500 to 1,000 pounds per acre. The excessive use of yard manure, which is rich in nitrogen, should be avoided. Where nitrogen is needed, it may be obtained cheaply and in good forms from such crops as red and crimson clover.

"7. To secure perfect fruit, the remedies given for the control of insects and diseases must be used.

"8. It will pay to thin apples. This practice exerts a good influence upon the proportion of first-grade fruit, and upon the continuous bearing of the tree, besides preventing the needless exhaustion of the soil.

"9. It will pay to carefully study the markets in reference to the advantages of careful grading and packing. The difference in price between fruit properly graded and packed, and that ungraded and poorly packed, is very marked; the poor fruit rather than the good in the mixed package fixes the selling price.

"10. Those who carefully observe the above suggestions, find that apple growing is a paying business."

CONTAGIOUS NATURE OF TUBERCULOSIS.

Dr. Nelson (Bulletin No. 118), of the New Jersey Station, thus sums up the proof of the contagious character of tuberculosis:

"Any disease produced by germs is contagious, infectious or "catching." In such diseases, there are special ways in which the germs are transferred from a patient to a healthy person. We have learned enough about consumption to know what constitutes exposure to this disease. As no one knows at any one time to what extent he is exposed, and as this disease takes a long time to develop, it is quite difficult to connect any case with a particular act of indiscretion. Under the circumstances, people in general have no very positive belief that consumption is really a contagious disease, though this has been definitely proven by scientific experiments. Many coincidences of exposure to the germs of consumption with development of this disease, which would be of uncertain value as proof of contagiousness if taken by themselves, are very suggestive when viewed in the light

of the knowledge that this disease is a germ disease. In this connection one bit of positive evidence outweighs hundreds of merely negative instances. As the care which people will exercise in dealing with this disease will largely depend on the firmness of their belief in its contagiousness or infectiousness, efforts to establish this belief are of value. Hence we shall proceed to refer to a few instances recorded by different writers.

"In 1860, Chauveau fed 'scrofulous' products to cattle and produced 'scrofulous' (consumptive) disease. Bollinger fed the milk of tuberculous cows to guinea pigs and tuberculosis developed in them. One way of testing milk to see if tubercle germs are present, is to inject a quantity into the abdominal cavity of guinea pigs. Even when the germs are present in so few numbers as to be incapable of demonstration by microscopic examination, the inoculated animals become tuberculous. Ernst inoculated milk of tuberculous cattle with sound udders to guinea pigs, and half of the inoculated animals became tuberculous. Milk from these cows fed to a number of swine, caused half of them to become tuberculous. Drs. Stalker and Niles separated three calves from their mothers at birth, and gave them the mixed milk from several tuberculous cows, but always heated the milk that one calf received. This animal did not become diseased; the other two became tuberculous. Dr. Schroeder found that one sample out of nineteen, secured from the general milk supply of Washington, D. C., produced tuberculosis when inoculated into a guinea pig. Dr. Ernst found three out of thirty-six samples of Boston milk to be similarly infectious. Prof. Bang placed two healthy bulls with the reacting division in his experimental herd, and within a year they, too, reacted when injected with tuberculin. Cornet inoculated guineas with dust from rooms occupied by consumptives, and compelled other guineas to breathe such dust, and produced tuberculosis in the experimental animals. It is a general observation that when cows occupy the same stalls and do not intermingle, that tuberculosis spreads from the diseased animal to its nearest neighbors first; while in case the stalls are used indiscriminately, the entire herd is irregularly affected.

"Many infants die of bowel troubles that suggest "feeding tuberculosis.' It has, in a number of cases, been found that the milk received as the sole food by such infants was received either from a consumptive nurse, or mother, or tuberculous cow. In Dr. Ernsts's extensive correspondence with physicians on this subject, he found eight cases reported in which infection was conveyed from mother to child; eleven cases of transfer from the cow to the infant and sixteen cases where this mode of infection was supected. Veterinarians are better situated to observe such cases than ordinary physicians. Dr. Stalker reports that five young people in one family died of con-

sumption during two years, while their ancestors had been free from the disease. An investigation of the herd belonging to the family showed that it contained seventeen tuberculous cows, and others had previously died of tuberculosis.

"Cases are on record of the children of non-tuberculous mothers, both human and bovine, being nursed by foster-mothers who were tuberculous and who had lost their own offspring by this disease. The previously healthy young, under these circumstances, began at once to pine away and finally die from tuberculosis. Prof. Bang reports that tuberculous horses are rare except in Denmark, where the uninque practice prevails of feeding these animals cow's milk. Where pigs are fed milk from tuberculous herds they show a large amount of tuberculosis. A case was reported to the Paris Academy of Medicine of an outbreak of consumption in a girls' boarding school; five girls died from intestinal tuberculosis and this led the physician to suspect the food. He found that this school had been supplied with milk from a cow with a tuberculous udder."

CONSERVATION OF MOISTURE FOR CROPS.

Bulletin No. 120 of the Cornell (New York) Experiment Station, deals with the question of the conservation of moisture for growing crops, and in the summary, Prof. Clinton thus condenses his deductions from the result of a number of experiments:

"1. The average rainfall of New York is sufficient for the growth of profitable crops. Owing to its unequal distribution and to the loss of nearly one-half of it by surface drainage, crops usually suffer from droughts.

"2. The first step towards conserving moisture is to put the soil in such a physical condition that it will be pervious to water or afford a reservoir for it.

"3. Water exists in the soil as free, capillary or hygroscopic. The free water within eighteen inches of the surface is injurious to the growth of cultivated plants. The capillary water is the direct source of their supply and should be conserved by all possible means.

"4. Capillary action of the soil depends upon the fineness of its particles and the closeness of their relation to each other. In coarse, loose, sandy or gravelly soils, the action is weak; in fine, well compacted soils, it is strong.

"5. When the capillary interstices or pores in the soil are con-

tinuous from the moist under soil to the surface, the moisture rises uniformly and passes off into the atmosphere by evaporation. If, however, these interstices or pores are made very much larger near the surface, the moisture is arrested in its upward movement, a result which is accomplished by light surface cultivation, which produces a 'soil mulch.' This mulch of loose soil answers much the same purpose as a board or carpet would in cutting off the direct connection of the capillary soil with the atmosphere. As soon as the soil becomes baked or encrusted, the capillary connection with the atmosphere is renewed, and another tillage is required to establish the soil mulch.

"6. A large amount of water is necessary for the plant, as its food is in a very dilute solution, and water is also used in building plant tissue.

"7. Moisture in the soil is necessary that nitrification and decomposition of organic matter may take place. Without it, the action by which the roots are able to corrode the solid rock and set free plant food cannot take place.

"8. The distribution of rainfall cannot be controlled by any known means. Dependence must be placed upon irrigation and the conservation of soil moisture.

"9. Irrigation is expensive and while entirely practicable in arid regions, yet in our section if flooding by irrigation should be followed by heavy rainfall the effect might be disastrous. Where irrigation is not a common necessity, it must be secured by individual enterprise, and is, therefore, expensive. In New York, we must depend largely upon conserving or preventing the loss of the moisture.

"10. The means by which moisture may be conserved are: Judicious plowing and tillage, mulches, underdrainage, wind-breaks, applications of lime, salt, etc., and adaptation of crop to the soil.

"11. The absorbing or capillary power of a soil depends upon the fineness of division of its particles.

"12. The plow is a most valuable implement for pulverizing and fining the soil. Fall plowing is recommended for heavy clays, the surface to be left rough and unharrowed. Fall plowed lands catch and hold the water.

"13. Surface tillage should begin early in the spring, as every day's delay after the soil is in fit condition means a loss of many tons of water.

"14. The harrow is valuable as an implement with which to establish and maintain a surface mulch. Frequent harrowing of an orchard will greatly lessen the evaporation from the surface.

"15. Where cultivators are used as conservers of moisture, many fine teeth are preferable to a few coarse teeth.

"16. Ridge culture is calculated to promote evaporation. To conserve moisture, practice level culture and so reduce the area exposed.

"17. The roller brings moisture to the surface by compressing the soil. On loose, sandy soils it is useful by compacting the particles. On clay, its use may prove injurious if followed by heavy rains. Where possible, it is well to follow it with a smoothing harrow to restore the mulch.

"18. A surface mulch of leaves and decaying vegetable matter is nature's way of conserving moisture. It also adds humus to the soil, which is the great store house for nitrogen and moisture. An herbage mulch can rarely be used in farm areas, however.

"19. Underdrains act beneficially in making soils porous above them and thus increasing their permeability; and in removing the free water and thus allowing the access of air, which is as necessary as moisture.

"20. Lime, gypsum and salt are used as conservers of moisture. An application of lime seems to have a beneficial effect on heavy clay and on light land. It also acts favorably on marshy, sour lands.

"21. Grasses and grains should be grown on clay and loamy soils, leaving sandy and gravelly lands for cultivated crops. The humus of tilled lands may be kept up by barnyard manures and by green manuring.

"22. The space between the trees in orchards should be left free for tillage. A growing crop makes such a demand upon the supply of moisture that the trees may be seriously injured.

"23. Determinations of soil moisture may easily be made by any one. The importance of this line of work is called to the attention of granges, farmers' clubs and horticultural societies.

"24. The importance of thorough tillage to conserve moisture cannot be made too emphatic. Deficiency in rainfall, with intensified agriculture is preferable to abundant rains and neglect by the cultivator. The soil will respond in a large measure according to the treatment it receives. Neglect it and it will fail to bring forth liberal increase, but cultivate it intelligently and thoroughly and it responds quickly."

PROFITS OF CHERRY CULTURE.

Prof. G. Harold Powell, of the Delaware Experiment Station, in referring to the profits of cherry culture in Delaware and elsewhere, presents the following figures from the farm of George T. Powell, of Ghent, New York, as taken from the Cornell Experiment Station No. 98:

"The profits of cherry culture depend on the skill and the business ability of the producer. In the industry are possibilities of $300 to $400 per acre, but such large returns are the price of extraordinary skill in growing and marketing the crop. In western New York, a fair profit would be from $30 to $70 per acre, while the profits are often much larger from sweet varieties.

"One acre of Windsors, containing 70 trees, 8 years old, yielded 84 pounds per tree, or 5,880 pounds, which sold for 10 cents per pound, or $588.00.

"Expenses,	Picking,	$58 80
	Sorting and packing,	20 00
	Packages,	30 00
	Express and commission,	70 00
	Cultivation, plowed once and harrowed six times,	3 50
	Fertilizers, 300 pounds kainit, 100 pounds of bone and 15 pounds of crimson clover seed,	4 25
	Interest on land at $150 per acre,	9 00
		$195 55
	Net profit,	$382 45

"The most profitable cherry tree in Delaware is probably one owned by Mr. W. H. Bird, of Hollyoak, Brandywine Hundred. The cherry is thought to be a seedling and the tree is from sixty to seventy years of age. Mr. Bird informs me that the tree yielded fifty dollars' worth annually of cherries for fourteen years, and that $80.00 were received for its crop in a single season. In 1897 it produced forty-four peach baskets of cherries, which is approximately 1,100 pounds.

"The following figures were furnished by Mr. C. G. Brown, of Camden, Delaware, from sales of Early Richmond cherries, grown on the farm of the late Jacob F. Brown, in 1897. Mr. Brown informs me that the trees are about ten years old, that the orchard had been neglected for a number of years, and that the yield was not over one-half of a full crop. Trees of Early Richmond at ten years of age should bear from forty to seventy pounds of fruit. The 240 trees yielded 7,600 pounds of cherries.

Net proceeds from the commission houses,		$184 30
Additional expenses, Picking,	$76 00	
Packages,	33 25	
		109 25
Net profit,		$75 05

Prof. Powell gives the following general directions for cherry culture:

"The cherry thrives best in a warm, dry, loamy soil. The sour cherry likes more moisture and is hardier. Soils too dry, but otherwise favorable to the cherry, can often be improved by the addition of humus and cultural aids. The land should receive frequent cultivation till the first or middle of July, and then be seeded to a clover crop. Plow early in the spring.

"Place the orchard on an elevation sloping north. The fruit buds will be retarded in the spring.

"Sweet cherries should be planted thirty feet apart and sour cherries sixteen to eighteen feet each way.

"Select buds for the future orchard from trees of a uniformly heavy bearing habit. The promiscuous selection of buds tends to make unlike trees in the orchard.

"The sour cherry should be pruned similar to the peach. The sweet cherry should have three to five main arms. Start the tops low.

"The finer types should be neatly packed in small packages. Too much care cannot be exercised in picking the fruit and placing it on the market in an attractive form."

JAPANESE PLUMS.

In Bulletin No. 139 of the Cornell (New York) Experiment Station, Prof. L. H. Bailey has the following concerning the Japanese plum, in relation to which he is probably the best authority in the United States:

"At first it was intended to include in this report copious extracts from the current press respecting the varieties of Japanese plums, but it so frequently happens that persons have different varieties under the same name that there is danger of adding to the confusion rather than diminishing it by too frequent quotations from contemporaneous writings. We have consequently set down the behavior of such varieties as have fruited with us this year, making such corrections of nomenclature as seem to be necessary in order to clarify the subject.

"I am still convinced that the Japanese plums have come to stay. By this I do not mean that they are destined to supplant the domestic and native plums, but that they are bound to supplant those types that are adapted to particular purposes and conditions. As a class,

they are vigorous, hardy and productive in tree, and the fruit is handsome, long keeping and covers a long season. Thus far, they have been comparatively free from black-knot, and until this year our trees have not been seriously attacked by the shot-hole fungus or leaf-blight. During the past season, however, this leaf-blight has been much worse upon the Japanese varieties than upon the domesticas alongside them, and this, too, in spite of the fact that they were thoroughly sprayed. The leaves did not drop to any extent, however, even though they were badly riddled by the fungus."

In reference to varieties, Prof. Bailey writes as follows:

"Correspondents are asking what varieties of Japanese plums I recommend. In reply, I will say that I never recommend varieties of any fruit for anyone to plant. The merit of a variety must be measured by the uses to which it is to be applied and by the tastes of the planter, quite as much as by its intrinsic characters. The correspondent rarely specifies whether he wants a red plum or a yellow one, an early or late, for dessert or for market. It is like asking a man at a distance what fence the questioner shall put in his back lot, without saying whether it is to be a pig fence, hen fence, sheep fence, cow fence or a fence merely to mark off his premises from his neighbor's. I can state what varieties I might plant for myself, but my selection might not be such as would please my neighbor. For myself, I should still adhere to my list of four varieties of two years ago—Red June, Abundance, Burbank, Chabot. I should place as second choice, Douglas, Breckmans, Satsuma, Hale and Wickson, and should expect that the last two would rise, upon further acquaintance, to a place in the first rank. If I wanted a yellow plum, I should take Georgeson, with Ogon for early. If I wanted the earliest varieties, without respect to size or quality, I should choose Berger, Engre, Earliest of All and Willard."

THE FORMATION OF ANIMAL FATS.

Bulletin No. 132, of the New York Agricultural Experiment Station, relates to the formation of animal fats and in relation to the general formation of fat has the following:

"It is quite commonly believed that the fat in an animal's body or in the milk secreted comes directly from the fat in the food eaten. With those who hold this idea, the animals seem to correspond quite closely to the dairyman's churn; the mastication, digestion and as-

similation of the food simply serve to separate from the other food compounds the fat particles already existing and to store them up in fatty tissue or in milk, as the beating, shaking and gathering in the churn unite the minute fat globules of the milk into firm masses of butter.

"Chemical tests, however, and microscopic examination prove that the animal fats are quite different from each other and from the fats in corn, linseed meal and clover hay; yet from a ration containing only these feeds the hog will form lard, the steer tallow and the cow butter. It would be difficult, if not impossible, to combine the ordinary foods so that any animal could select, from the mixture, fats like in kind and quantity to those in its own adipose tissue.

"This theory of the direct transfer of fats was held for a long time even by scientists, but it is now abandoned by them. Various other theories have been advanced. Some have held that the body and milk fats are formed by simple chemical transformations of the various food fats; others than the carbohydrates, which contain no chemical elements not found in fats, are chiefly concerned in their formation, and others that the nitrogenous compounds of the food, the proteids, are broken up to form fats, the nitrogen, which protein contains and fat does not, being excreted in the urine.

All scientific observers know that the problem is much too complex to be explained by the mere transfer of fat particles, and find the solution too easy. The food can be followed without much trouble until it has been digested; samples can be obtained from the mouth, stomach, intestines and even from the vessels into which it is absorbed, liquified food has been poured and the changes studied; but the transformations made in the living tissue are beyond the direct reach of the microscope and chemical reagent. The investigation must needs be made by giving foods of a particular character fat free, protein free and noting the effects produced in weight and composition of flesh, fat, milk and refuse matters, or by feeding ordinary materials whose composition is known and determining by analysis of the products and excreta the disposition made of the different materials.

In this way foreign investigators have demonstrated that the fat of sheep, pigs, geese and dogs upon which they experimented could not have come wholly from the fats in the food fed, nor even from the fats and the transformed protein, but must have come in part, at least, from starch and sugar and other carbohydrates. These experiments have not proven that the fat in the food and the protein in the food do not help to make the body fat, but they have proven that they do not make all of it."

TUBERCULIN AND TURBERCULOSIS.

Dr. Nelson, in one of the bulletins of the New Jersey Experiment Station, thus outlines what may be said to be known relating to the action of tuberculin:

"1. Cows with advanced tuberculosis fail to react. The tuberculin present in such animals has already caused reaction (the hectic fever) so repeatedly that no great reaction is possible. As such cases do not require tuberculin injection to discover their diseased condition, this source of failure does not count against the value of the test.

"2. Cases of slight reaction are not distinguishable from cases in which the temperature of a sound animal is a little higher one day from what it was the day before. To destroy the former it is necessary to arrange them in the order of their certainty, and beginning with the most certain ones to slaughter them seriatim until the carcasses cease to show the lesions of the disease. Or these cases may be re-injected six or more months later. If they are sound to physical inspection, it may be considered as perfectly safe to let them wait.

"3. Cases that have been previously injected and have given reaction, give less certain reaction at a later test. Experiments show that the power to react is regained after six or more months of rest. Different cows differ in these respects. Prof. Bang found that 7 to 20 per cent. of the cows lost the power to react on the second injection; others require three or four repetitions before losing sensibility. Some observers report that a reaction can be secured if a sufficiently large dose be injected.

"4. Cases of recent injection and some cases of latent disease fail to give a reaction. But these can be secured by testing the entire herd again later. Prof. Bang found that on a second injection of some herds he secured 10 per cent. additional reactions, but the third injection added only one animal, so that if a herd be tested two or three times within two years, it may be practically freed from cases of this disease.

"5. Very rarely has it been found that animals with diseases other than tuberculosis respond to the injection of tuberculin. Prof. Bang found two cases of reaction in which the post mortem failed to show presence of tuberculosis. Evidently these cases are too few to be counted against the test. After including all sources of errors, the tuberculin test applied by experienced persons shows at least 90 per cent. of efficiency. By its aid we are able to eradicate bovine tuberculosis."

DIGESTIBILITY OF STOCK FOODS.

In Bulletin No. 149, the Michigan Experiment Station discusses the feeding of dairy cows from a Michigan standpoint, but there is much in the results of their experiments that will interest and benefit the Pennsylvania dairyman.

So much depends upon the proportion of the food which is actually digestible that the station has very properly given much attention to this phase of the question, the experimentors realizing that it was the digestible portion of the ration which produced the milk and not its total bulk. In referring to digestion experiments, the bulletin alluded to has the following:

"The first step in one of these digestion experiments is by chemical analysis to find out how much protein, carbohydrates and fat 100 pounds of the food stuff in question contains. Two animals are then weighed daily for a week and fed a weighed ration of the material to be tested. At the end of that time the real experiment begins. The animals are weighed daily for the next period, usually of six or seven days, and both the amount of food they consume and the amount of excrement they void are carefully weighed and analyzed. From the data thus obtained, the amount of protein, carbohydrates and fat digested is found by subtracting the amounts of each in the dung from the amounts of each in the feed which the animals consume in the given time. For instance, suppose it was desired to determine what share of the nutrients, protein, carbohydrates and fat, cattle were able to extract from clover hay and utilize in their bodies. Two steers would be fed clover hay for a week, the ration being so regulated that there would be neither gain nor loss in weight. Let us next suppose that the following period of the experiment was six days, and that in that time each steer consumed twenty pounds per day of clover hay. The clover hay would contain, as shown by chemical analysis, per hundred pounds

Water,	15.3 pounds.
Ash,	6.2 pounds.
Protein,	12.3 pounds.
Crude fiber,	24.8 pounds.
Nitrogen-free extract,	38.1 pounds.
Fat,	3.3 pounds.
	100.00 pounds.

"In the six days, each steer would consume 120 pounds of clover hay, containing, according to this analysis, 14.76 pounds of protein. For, if 100 pounds of hay contained 12.3 pounds of protein, one pound of hay would contain .123 pounds which, multiplied by 120 gives 14.76, as the total amount of protein in the 120 pounds of clover hay consumed in the six days. By using the table of analysis in this way we find that in the 120 pounds of clover hay there would be, besides the 14.76 pounds of protein, 29.76 pounds of crude fiber, 45.72 pounds of soluble corbohydrates, or nitrogen-free extract as they are here called, and 3.96 pounds of fat.

Let us suppose next that the dung for these six days is weighed, sampled and analyzed. It would weigh not far from 25 pounds per day per steer, or 150 pounds for the six days. A chemical analysis would show that this dung contained, per hundred pounds, 47.02 pounds of protein, 10.55 pounds of crude fiber, 11.89 pounds of nitrogen-free extract and 1.373 pounds of fat. The hundred and fifty pounds of this material would contain 7.08 pounds of protein, 15.77 pounds of crude fiber and 17.83 pounds of nitrogen-free extract and 2.06 pounds of fat. These materials having passed through the body and been excreted from it unaltered, could not have been digested. If, therefore, we subtract the amounts of each nutrient in the dung from the amounts of the same material in the food consumed we shall have the amount digested, the amount taken out of the food by the digestive organs of the animal and utilized in its growth or maintenance. This is done in the following table:

	Protein.	Crude fibre.	Nitrogen—free extract.	Fat.
	lbs.	lbs.	lbs.	lbs.
In 120 pounds hay,	14.76	29.76	45.72	3.96
In the 150 pounds dung,	7.08	15.77	17.83	2.06
Amounts digested,	7.68	13.99	27.89	1.90

Taking the protein as an example, we can determine the proportion of it digested by dividing the 7.68 pounds by the weight of it given in the feed, 14.76 pounds, the result would be 52, the per cent. of protein of clover hay digested by the steer. In the same way the per cents. digested of the other constituents of the ration are found. This would be for crude fiber 47 per cent., for nitrogen-free extract 61 per cent., and for fat 48 per cent. Results thus obtained are called digestion co-efficients. The digestion co-efficient of the protein of clover hay is 52. The digestion co-efficient of crude fiber in this experiment would be found in the same way to be 47, that of the nitrogen-free extract 61 and that of the fat, 48.

"The two steers are fed and treated exactly alike. If both animals are normal and healthy and no mistakes are made in the prosecution of the experiment, the digestion co-efficients found by one steer should coincide very closely with those found by the other. Repeated experiments have shown that cows do not differ much as to the amounts of protein, carbohydrates and fat they can digest from the same material. The digestion co-efficients found by one animal, therefore, will hold good approximately for all other animals of the same species. It is not true on the other hand, that the digestion co-efficients of one fodder will apply to any other. For instance, while but 52 per cent. of the protein of red clover is digestible by cows, 73 per cent. of the protein of pasture grass was found digestible in Pennsylvania, while of timothy less than half the protein was found digestible at the Maine and Utah Experiment Stations. Of the protein of corn silage about 53 per cent. is digestible. The protein of linseed meal is much more digestible, fully 87 per cent. of it being utilized by the cattle. The protein of wheat bran is also highly digestible, the digestible coefficient being 78."

COST AND MANNER OF GROWING BEETS FOR SUGAR.

Prof. G. W. Churchill, Agriculturist of the Geneva Experiment Station, gives the following outline of the manner in which the sugar beets, intended for sugar experiments, were produced at the Station:

"A hand seeder was used; fifteen pounds of seed was used per acre; hand cultivator was run through the patch about June 1, and as soon as the rows could be plainly distinguished, the larger cultivator was started; the plants were as nearly as possible thinned out to from six to nine inches, in rows twenty inches apart."

Mr. Churchill thus describes the subsequent work on the two-acre plot:

"It was intended to have the beets left eight inches apart in the rows. It was found necessary in some cases, however, to vary these distances on account of the spaces left by the seeder, and in order to preserve the strongest plants.

"After the final thinning the beets received another cultivation to loosen the ground, as it had become more or less compacted by rain and the passing of the men while thinning. After this but one more cultivation with the horse cultivator was given, for the beet tops covered the ground to such an extent that a horse could

not pass through without doing serious damage. The subsequent hand labor was small and would not have been considered necessary by many growers, but in order to adhere to strictly clean culture, men were sent through the field once to pull the weeds that had escaped previous cultivation. This consumed less than one day's time for two men, and at the time of harvesting the crop, the field was entirely clear of weeds.

"The harvesting of the beets began on September 22. Two methods were tried; first, plowing three furrows for each row, the third furrow turning out the beets, and plowing two furrows for each row, after which the beets were pulled by hand. The last named method seems preferable where the beets do not have too long tap roots, because, in the first method, the small beets are covered by the furrow and it is more work to uncover them by hand than it is to pull them out when they are standing upright and in plain sight.

"As the beets were pulled out they were thrown in heaps, and men followed and cut off the tops. The harvesting, which includes pulling, topping and hauling, was found to be the most expensive operation connected with the growing of this crop.

"It should be borne in mind that the very best of culture was given throughout the season and no expense spared in either hand or team labor, and that a liberal allowance has been made in all cases wherever estimates were necessary. Some mistakes were also made which were costly, and which can be avoided in the future. On the whole, therefore, it is probable that these figures err on the side of too great cost, and that with the experience gained in this season's work, we can cheapen the cost of growing an acre of beets quite materially.

"In the table below, we give the cost of growing one acre of sugar beets, based on hand labor at $1.25 per day for hoeing and thinning, and team at $3.50 per day; and on hand labor at $0.75 and team at $3.00:

Cost per Acre of Growing Sugar Beets.

	Expensive Labor.	Cheap Labor
Fitting ground,	$7 00	$6 00
Sowing fertilizer,	1 12	1 12
Sowing seed,	1 25	1 25
Hoeing, thinning and weeding,	23 43	13 88
Harvesting,	24 25	14 80
Horse cultivation,	2 00	2 00
Hand cultivation,	3 75	2 25
Seed,	3 00	3 00
Fertilizer,	10 00	10 00
Total,	$75 80	$54 30

"Doubtless these figures will be criticised on the ground that they

are too high, but it is probable that, if careful accounts were kept by 100 farmers of the cost of everything connected with the growing and delivery to the factory of one acre of properly grown sugar beets, the average would not fall below $50.00, with the present methods and machinery at the command of the grower.

"The yield per acre, as harvested, was 32,548 pounds, or approximately 16¼ tons.

"In order to determine the actual yield of perfectly clean beets, topped as they would be when sent to the factory, a lot weighing 1,000 pounds was thoroughly washed and dried, after which the crowns were removed.

Weight of beets taken, ...	1,000 pounds.
Loss by washing, ...	49 pounds.
Weight of crowns, ...	73 pounds.
Weight of washed beets without crowns, ...	878 pounds.

"At this rate the yield of topped, washed beets was 14 tons 577 pounds; of topped, unwashed beets, 15 tons 200 pounds. At $4 per ton, the returns per acre would not be over $60."

PLANTING, TILLING AND PRUNING APPLE ORCHARDS.

Bulletin No. 38 of the Delaware College Agricultural Experiment Station gives the following advice as to the planting, tilling, pruning and treatment of young apple orchards:

"The wisdom of mixing the species of tree fruits in an orchard is a perplexing problem. It is a personal question, however, and its successful outcome is largely due to an unusually skillful orchardist. On general principles, the mixing of fruits is to be discouraged. No two kinds of trees grow with the same rapidity, or require the same treatment. The peach will outgrow the apple, and rob the young trees of their proportionate share of plant food. The blight of the pear may be transmitted to the apple, and the treatment of a blighting pear orchard would not be best fitted to the continued growth of the apple. We believe it wiser to set an early-bearing variety of apple between the trees, and to cut it out when its growth interferes with the permanent kinds. This practice is followed by

Mr. E. H. Bancroft, of Camden, who is setting Missouri Pippin and Wealthy between the rows of Stayman and York Imperial in his young apple orchards.

"Small fruits may be set for a few years between the rows, without injury to the young orchard, provided sufficient plant food is furnished for both the apples and the secondary crop. Vegetables may be grown under similar condition, or peas and oats, to be cut for hay, may be sown for two or three years, by leaving a space on each side of the row for cultivation. Whatever the crop, it should be one that requires frequent tillage until the middle of June or the first of July. The success in growing small fruits and vegetables, and a vigorous young apple orchard at the same time, is also a personal question, and depends on an intelligent handling of the trees and land, and the liberal feeding of both crops.

"The cheapest apple tree is the one that is grown best in the nursery. Uniformly grown two year old trees, not too large nor stunted, but of medium size, with an abundant root system, a well-formed top, and a stocky, vigorous trunk, are the only ones that should go into the young orchard. Buy from local dealers. A Delaware Newtown Pippin is preferable for Delaware to the same variety from Oregon, where the Newtown Pippin has acquired local climatic features. If the desired variety is not handled by local nurserymen, then buy from dealers situated in a similar climatic belt.

"The young apple orchard should receive deep tillage the first few years of its life, to prevent the establishment of a system of surface roots, and to form a deep rooted habit in the trees. Only those main roots which have a downward tendency can exist, as the horizontal surface roots will be broken off. Plow orchards as early each spring as the team can get in it, at least six inches deep, except close to the trunk, and cultivate the land as often as once in two weeks till the middle of June or first of July. Late plowing may extend the wood growing season, which ends about the middle of June or the first of July, and send the wood into winter in a sappy condition. Seed the orchard at the last cultivation with a clover crop, such as crimson clover, rye, buckwheat, winter oats or the trailing varieties of cow peas, using the non-leguminous plants when the trees are making too much growth, and continue this treatment while the orchard flourishes under it.

"The young apple orchard in Delaware requires the most intelligent pruning for the first two years. Varieties like the Winesap and its seedling, York Imperial and others, are inclined to a drooping, tortuous habit. If this tendency is not corrected, the trees become sprawling and unsightly. An upright, symmetrical form can be induced by a systematic heading-in of the annual growth for a few years, always cutting the wood to a bud that will send an upright

branch. The branches become more stocky and the tree assumes permanently a better form.

"Double working, or grafting a permanent variety on a stock of a single variety, is seldom practiced except in dwarf pear culture. The writer has had considerable practical experience with this method in starting young apple orchards, and the results give it emphatic value, when intelligently followed. The system consists in top-working the permanent variety on a vigorous, upright-growing stock, after it is well established in the orchard. In Delaware, the Ben Davis is desirable for winter, and the Red Astrachan as a stock for earlier kinds. Both are upright, healthy, long-lived trees. Among the principal advantages of this system are:

"1. It helps correct the sprawling habit of the Winesaps and the like, and furnishes a uniformly straight, clean trunk for all varieties.

"2. It hastens fruitfulness from one to three years in young orchards.

"3. It provides a strong, healthy trunk for varieties of particular excellence, which have weak bodies, and which eventually become diseased. The Gravenstein, King, and Twenty-Ounce apples are longer lived trees when worked on a vigorous stock, the varieties either having poor trunks or being particularly susceptible to body diseases.

"4. It gives the grower an opportunity to selections of the permanent variety from trees with a regular, heavy bearing tendency, an abundance of hardy foliage and high colored large sized fruit. The system is practiced by some of the most intelligent apple growers of the north, and will be more generally used in the future when its distinct advantages are more fully understood."

TUBERCULOSIS IN DENMARK.

Prof. Bang is quoted, in Bulletin No. 118 of the New Jersey Station, as giving the following as the mode followed in Denmark in the attempt to eradicate tuberculosis:

"1. The herd is inspected by a veterinarian and all evidently tuberculous animals are at once removed and carefully slaughtered.

"2. The remainder of the herd is tested with tuberculin, given free by the government, provided the farmer agrees to follow, rigidly, the remaining steps of the process.

"3. All cows that react and all adult animals of little value, that have shown evident reaction, are carefully slaughtered under inspection. If the beef seems to be prime, the carcass is marked as having been slaughtered as tuberculous beef. Those who buy it secure it at half price, and, of course, if it is thoroughly cooked it is as safe for food as any beef.

"4. The remaining reacting animals are carefully separated from the non-reacting animals, either in a separate building or in the opposite end of the same building, a complete partition being at once constructed between the two divisions. The partition is made of matched boards, and is papered. There is no opening left by which air can pass from one compartment to the other. The drainage is so arranged that nothing can soak beneath this wall. If possiblé, a separate set of attendants care for each division. Where but one man milks and cares for all the cows, he serves the sound division first, then he changes overshoes and outer garments for special clothing used only when with the reacting division.

"Both compartments are cleaned and disinfected as follows: All manure and litter is removed and burned or treated with germicides. The floor, walls and ceiling are wiped with a wet rag, frequently rinsed in disinfectant solution. The the entire interior is sprayed with one of the following solutions, either A, B or C.:

"A. One pound chloride of lime in four gallons of water.

"B. One-half gallon crude sulphuric acid slowly mixed with one-half gallon crude carbolic acid, then slowly diluted with twenty gallons water.

"C. In a wooden tub put eight gallons warm water, add one ounce of corrosive sublimate, let stand a day to thoroughly dissolve. This is a powerful poison. It must not be used in contact with metal instruments, but can be applied with a brush. All parts that can be reached by the tongues of the animals must be rinsed off with pure water after this disinfectant has been applied.

"When walls and ceiling are dry they are whitewashed. (Corrosive sublimate can be added to the whitewash.)

"6. All the milk produced by the reacting animals should be heated to 185 degrees F. before use. No milk should be given to the calves without this pasteurization process unless its purity is undoubted.

"7. All calves dropped by reacting cows should be put with the non-reacting division before they get a chance to suckle their mothers. For the first day they should receive their mother's milk (colostrum), after heating it to 140 degrees F.

"8. The sound herd should be tested a second time within a year and all reacting animals removed to the other divisions.

"9. In buying a new cow she should be treated at once, so as to know in which division to place her.

"10. The reacting herd should be inspected by physical examintion at least once a year to discover if any cases have become so advanced in tuberculosis as to show physical signs of the disease, when they should be sent to the slaughter house as tuberculous beef."

LOSS OF HUMUS.

Bulletin No. 53 of the Minnesota Experiment Station, gives the following summary as the result of a series of careful experiments having for their object the close estimation of the loss of humus by various crops and by different rotations of crops:

"1. When wheat was grown continuously on the same plot there was an annual loss of 171 pounds of nitrogen per acre. About 25 pounds were removed by the crop, while 146 pounds per acre were lost from the soil by the wearing away of the humus.

"2. When wheat was grown in a rotation, after clover, there was a yield of five bushels per acre more of wheat than when grown continuously. When manure was used and clover was grown there was a gain of nitrogen, and at the same time larger yields were obtained. When corn was grown in a rotation, it yielded 17 bushels per acre more than when it was grown on the same plot continuously.

"3. When corn, oats or barley was grown continuously on the same plot and no manure used, there was an annual loss of from 80 to 200 pounds of nitrogen from the soil, the larger portion of which was not carried away in the crop, but was lost by the destruction of the humus. The annual loss per acre of humus when wheat, corn, oats or barley was grown continuously ranged from 1,500 to 1,800 pounds.

"4. A loss of humus from the soil has made the soils lighter colored, caused them to weigh more per cubic foot and has reduced the power of the soil to store up water.

"5. When summer fallowing is extensively practiced the yield of the following crop is increased at the expense of rendering five times more nitrogen available than is required by the crop. The available nitrogen, if not utilized by the crop, is not stored up in the soil but it is lost.

"6. Cow manure, green clover and meat scraps produce valuable forms of humus, rich in nitrogen. The humus produced is capable of combining with the phosphoric acid and potash of the soil to form humates.

"7. Sawdust, straw and carbohydrates, as sugar, produce a humus rich in carbon. This humus has less power to combine with the phosphoric acid and potash of the soil than humus formed from materials richer in nitrogen.

"8. The humus from soils which have been cropped for a series of years contains less nitrogen and mineral matter, and more carbon than the humus from soils that have not been cultivated.

"9. Forest fires may cause a loss of 75 per cent. of the total nitrogen of the soil. The practice of burning over new land is sometimes carried to such an extent as to injure the permanent crop producing power.

"10. Soils which stand in need of humus are sandy and sandy loam soils which have been cultivated a number of years to corn, potatoes and small grains, without the use of stable manures or the proper rotation of crops.

"11. A prairie soil, before it is brought under cultivation, will contain about 1,500 pounds of phosphoric acid and about 800 pounds of potash per acre, combined with the humus. After twenty years of cultivation, if the humus is not kept up, there will be about 400 pounds of phosphoric acid combined with the humus."

DEHORNING.

In Bulletin No. 54 of the Cornell (New York) Experiment Station, Prof. Roberts refers to the following result of the work of a commission appointed by the Canadian (Province of Ontario) government to examine into and report upon the results of dehorning:

"Evidence was received from the representatives of all the interests affected by the practice, including farmers, dairymen, drovers, exporters, wholesale and retail butchers, cattle market attendants, tanners, hide merchants, veterinary surgeons, medical practitioners and members of humane societies—ninety-eight in all.

"Of the farmers examined, nearly seventy in number, all who had either performed or seen the operation performed, with three or four exceptions, were strongly in favor of it, the majority stating that they were prejudiced against it on the grounds of cruelty until they gained a practical knowledge of it. Of the farmers opposed to the practice, not more than three or four had ever seen the operation, but they thought it cruel and unnecessary.

"Evidence as to the loss caused by animals using their horns upon each other was given by cattle buyers and others in frequent attendance at the cattle market, and also by butchers and tanners.

"Among veterinary surgeons a considerable conflict of opinion was found to exist. As in the case of the farmers, those who had seen the operation and observed its effects were in favor of it, while those who had not seen it were opposed to it.

"Indeed, as regards all the evidence received by the commission, it might almost be given as the rule that where the operation was properly and skillfully performed, those witnessing it, however, prejudiced before, became converts to it, while the great bulk of the opposition came from parties not acquainted with the operation, and who entertained exaggerated ideas as to its severity.

"In no case were witnesses able to refer to an instance where a farmer was dissatisfied with the results or willing to give up his right to continue the practice, after having performed the operation.

"In addition to the evidence as to the amount of pain involved in the operation, much evidence was received as to the commercial advantages accruing from the operation, and emphasizing the point that a great deal of suffering is prevented by the removal of the horns."

In Bulletin No. 41 of the Maine Station, Profs. Gowell and Russell thus outline the results of dehorning at the station:

"1. Dehorning is to be recommended because dehorned cattle are more easily cared for than those with horns, and because dehorned cattled enjoy life better. 'A great deal of suffering is prevented by the removal of horns.'

"2. The best time to dehorn cattle is during cold weather when there will be no trouble from flies.

"3. To dehorn mature animals, clippers should be used that will remove the horn perfectly at a single stroke and in a moment of time.

"4. With suitable clippers properly used, the operation is simple and very quickly performed.

"5. When it is skilfully performed, animals do not give evidence of great suffering as an effect of dehorning. The tissues injured in dehorning are not very well supplied with nerves and they are quickly cut through. Good evidence that dehorning is not very painful is the fact that cattle will resume feeding immediately after being operated on, and the yield of milk in cows is not perceptibly affected. Compared with castration of colts and calves, dehorning may be considered painless.

"6. To those who are familiar with the operation of dehorning and the results of it are its most enthusiastic advocates.

"7. To prevent the growth of horns, calves under three weeks of age can have the embryo horns removed with one stroke of a sharp knife,

or they can be treated with caustic sufficiently powerful to destroy them.

"8. In the past, efforts have frequently been made to prevent the practice of dehorning on the ground that it caused needless pain. It would seem to us that efforts can now better be expended by endeavoring to have the last relic of a horn removed from our domestic cattle, who ceased to need them when they came under the protection of man. Horns may be sometimes ornamental, but it is evident that they are usually useless, expensive and dangerous luxuries."

BEET SUGAR PRODUCTION.

Dr. VanSlyke, of the New York Experiment Station (in Bulletin No. 135), gives the following as the result of experience at the Station in the production of sugar beets:

"The following elements determine whether sugar beets can be grown at a profit: (1) Richness in sugar; (2) purity of solids; (3) yield of beets; (4) cost of crop; (5) market price.

"1. Richness in Sugar.—Analyses of about 140 samples of beets grown in different parts of New York State during 1897 show a variation of sugar in the beets from below 12 to over 18.5 per cent., with a general average of 15.3 per cent. This average is somewhat higher than shown by other states.

"The following conditions exercise a marked influence upon the development of sugar in beets: Climate, variey of beet, quality of seed, kind and quantity of plant food, soil, methods of cultivation, size of beets and time of planting and harvesting.

"2. Purity of Solids.—The coefficient of purity is the proportion or percentage which the sugar constitutes to the total solids in the juice, and is found by dividing the per cent. of sugar in the juice by the per cent. of total solids in the juice. The higher the coefficient of purity the larger will be the proportion of sugar crystallized out in manufacture. The purity is influenced by maturity of beet, kind of fertilizers used, size of beet and portion of root. Immature beets contain sugar of low purity, also beets grown with excess of highly nitrogenous manures. The sugar of large beets has a lower coefficient of purity than in smaller beets. The proportion of beet growing above the surface of the soil has sugar of inferior quality. The coefficient of purity varied from below 75 to over 87, with an average of 82.5.

"3. Yield of Beets.—Twenty tons of marketable beets an acre may be regarded as a maximum yield in commercial operations. An average of ten to twelve tons may probably be expected in favorable seasons in this state.

"4. Cost of Production.—The cost of raising an acre of beets may be placed between $40.00 and $50.00, when the conditions are favorable.

"5. Market Price and Profits.—There is good reason to expect that beets will bring from $4.00 to $5.00 a ton, according to varying conditions of sugar, purity, etc. In general, a profit of $5.00 to $10.00 an acre above all expenses may be regarded as a reasonable expectation from the crop.

"6. General Considerations.—The sugar beet is to be grown as an added crop, with comparatively small acreage at the beginning, increasing as conditions favor. The educational value derived from growing sugar beets is considerable. The farmer who learns to grow sugar beets well will grow other crops better for the experience. The soil on which sugar beets have grown is left in better mechanical condition than by other crops."

Prof. VanSlyke gives the following as his opinion of the outlook for the sugar beet industry:

"1. The experience of 1897, so far as a single season can show, appears to demonstrate that our climatic and soil conditions are adapted to the growth of beets which are satisfactory in quality and quantity of yield.

"2. The cultivated lands of central and western New York may be so managed as to compete with any in the United States in those lines for which they are adapted.

"3. The ability of the American farmer to take up a new enterprise successfully is a helpful factor. American inventive genius may also be relied upon to provide implements necessary to cheap culture.

"4. At present there is an unlimited home market at good prices for all the sugar that can be produced, but it cannot be definitely known how long this condition will last.

"5. An added cash crop yielding fair returns is most desirable for our farmers."

The same authority thus alludes to some of the doubtful items involved in sugar beet culture:

"1. To cultivate a plant so sensitive in regard to its content of sugar as the sugar beet requires such careful attention to details as is demanded by no other crop commonly grown on our farms.

"2. The danger regarding exceptional yields as representing the average. An average of twelve tons of beets per acre for the first few years may be regarded as a fair average, if we judge by results secured in other places.

"3. There is danger that capital may be inefficiently directed in the erection of factories, as this is a line in which eastern men have had no experience. Beet sugar manufacture should be entered upon with great caution, and only after exhaustive study of the problems involved. Farmers should be cautious about taking stock in factories unless the men who control the enterprise are personally known and trusted by them.

"4. The question of home and foreign competition must not be ignored. Strong competition will come from the Pacific States until their soils become exhausted. We shall be brought into competition with the lower wages paid in Europe, if at any time strong sentiment existing in favor of free sugar comes to find expression in tariff regulations."

THE SOURCE OF FAT IN MILK.

Bulletin No. 132 of the New York Experiment Station, gives a full account of an experiment having for its object the detection of the source of the butter fats in milk. The experiment is thus outlined by Prof. Hall, of the Station force:

"For the purposes of the experiment, it was necessary to have a large quantity of food as nearly fat-free as possible, so a thousand pounds of finely chopped timothy hay and fourteen hundred pounds each of corn meal and ground oats were sent to the works of the Cleveland Linseed Oil Company, at South Chicago, and were there treated repeatedly with a solvent. It was found impossible to extract all the fat, but so small a quantity was left that a good ration could be fed which would contain only two ounces of fat daily. This process rendered the food somewhat less palatable to the animal, so a cow was selected with a vigorous appetite, a young grade Jersey, which had been giving milk about four months and was somewhat thin in flesh. The experiment continued from April 12 to July 30, and, with few exceptions, the animal ate the rations readily and completely.

"Beginning with the second week of the experiment, the milk was weighed and daily samples taken for analysis throughout the entire time of feeding, 102 days.

"Beginning at this time, also, the urine and feces were collected separately, the cow being watched night and day for this purpose, were weighed and samples taken for analysis daily for sixty-six days, until the last period of the experiment.

"For the first two weeks the cow was given foods containing the normal amounts of fats to determine her behavior under natural conditions. For the next eight days, she was fed a ration of the extracted foods similar in amount to that first fed—ten pounds hay, six pounds corn meal, five pounds ground oats and one pound wheat gluten. For the next week one-half pound more daily wheat gluten was given to increase the proportion of protein up to or beyond the animal's probable full requirement for maintenance and milk production. Then the gluten was decreased and the corn meal increased at the rate of one-fourth pound daily until at the end of five days no gluten was fed and the corn meal had been raised to seven and one-half pounds. This was continued for eight days, at the end of which time the amount of each ingredient of the ration was diminished one-third. This was thought to be less than the animal's needs and was continued for twenty days. Then for three days one-fourth pound gluten was added daily and finally the original ration of extracted foods was fed for thirty-six days.

"The cow seemed to keep in perfect health throughout the experiment, showing no signs of fever or other unnatural symptoms, although she drank larger quantities of water than usual. There was a gradual and quite uniform increase in weight and an apparent laying on of fat throughout the experiment, except during the twenty days of scant feeding, when there was no especial change. To judge by all outward signs she was a fatter animal at the end of the experiment than when the feeding began.

"The milk secreted while feeding the extracted foods was similiar in composition to that produced from the normal foods. There was a drop in the percentage of milk solids for a few days following the change to the fat-poor foods, but in a very short time the milk became as rich as before. During the 95 days, 62.9 pounds of milk fat was produced, while the food contained only 5.7 pounds of digestible fat, so that 57.2 pounds of milk fat could not have come from food fats. It is not possible, either, that this surplus came from fat already stored in the cow's body. By analyses, made in England, of the entire body of a well-fed ox, it was found that such an animal contained only 7.1 per cent. of fat. Even if this cow had been as fat as the ox, which is improbable, her body would have contained at the start only 61 pounds of fat, practically all of which would have been needed to produce the 57.2 pounds of fat in the milk; and the removal of this from her body would have left her exceedingly thin in flesh. On the contrary, she was lean when the experiment began and apparently gained fat steadily. She certainly was 47 pounds heavier at the end and could not have made all this gain in muscular tissue, for flesh formation requires nitrogen, and during fifty-nine days of the time, all, or very nearly all, of the nitrogen consumed by the cow reappeared in her milk and excreta.

"If the fat had been taken from her body and its weight replaced by water or food in the intestines, as some may suggest, she would necessarily have appeared full or bloated; for such a substitution would require the presence in stomachs and intestines of 104 pounds of matter to replace 47 pounds of increased weight and 57 pounds of removed body fat. It is safe to say, then, that the fat in the milk could not have come from fat in the food or from that stored in the animal's body.

In the fifty-nine days during which records of the income and outgo of both fat and nitrogen were kept, 38.8 pounds of fat was found in the milk. According to any accepted theory of fat formation by protein decomposition, the nitrogen of the protein and part of the other elements are not used, the nitrogen appearing in the urine. The highest figures given by any investigator allow 51.4 pounds of fat from 100 pounds of protein; so to form this 38.8 pounds of fat the metabolism of at least 75 pounds of protein would be required. In the urine, however, there was found only nitrogen enough to account for the decomposition of 33.3 pounds of protein or the formation of 17.1 pounds of fat, leaving 21.7 pounds of fat unaccounted for. In this fifty-nine days, the digested fat was only 3.3 pounds and the cow's weight increased 33 pounds without flesh formation as revealed by disappearance of nitrogen. The fat in the milk then could not have been formed from fat in blood, fat in body or protein in food, singly or all united, so part, at least, must have been formed from the carbohydrates of the food."

THE CODLING MOTH.

In Bulletin No. 51 of the Agricultural Experiment Station of Nebraska, Prof. Card thus sums up their experience with the codling moth and the modes of preventing its ravages:

"The life history of the insect is of little importance to the orchardist, except in so far as it enables him to cope with it. The careful determination of the habits of our enemies usually reveals some vulnerable point, but without such study or without knowing the habits our efforts may be wholly misdirected. The commonly accepted plan of fighting the codling moth has been to spray the trees with arsenites, either Paris green or London purple, as soon as the blossoms have fallen, and repeat the operation once or twice thereafter at intervals of ten days or two weeks. The efficacy of this

treatment, in many cases, has been proven beyond a doubt, yet its efficiency has, to my mind, been equally well proven in other cases. The assumption has been that the moth begins its work at blossoming time, and that by spraying immediately afterwards, we may catch the young larvae at the time they begin work.

"It will be remembered that this year our orchard was in full bloom and many petals beginning to fall on May 6, while two or three days later the bloom had fallen from all varieties except the Janet. About May 10 would have been the time to do this spraying as ordinarily recommended. Note, however, that the first eggs of the codling moth were found in the orchard on June 3 and the first larva June 12, the latter appearing in considerable numbers from the 12th to the 15th, nearly a month after the time we are supposed to spray. The question arises as to why we should waste our powder so long before the enemy is in sight? While the orchardist is assiduously squirting poison at the apples, in the full expectation of an easy victory, the enemy, snugly encased in his silken armor, is lying in ambush about the trunk of the tree or in the cellar where the previous crop was stored. But another factor enters into the problem. When the blossoms fall the calyx cup is wide open, but soon after begins to close. This year they were practically closed by the 20th of May. Since the young larvae so often begin their work within this cup, it is important that we have a dose of poison there prepared for them. It can only be put there while the cup is still open. Therefore, to do this we must spray soon after the blossoms fall, as directed. But the efficacy of this spraying plainly depends upon getting the poison in this position, having the cup close over it, and holding it there until the larva comes. Therefore, the nearer the time at which the cup closes that the spraying can be done, and still get the poison inside, the better, for the less danger there is of its being washed away.

"The first spraying in our experiments this year was done May 18, but it had been delayed a little too long, for then many of the calyx cups were nearly closed. Apparently about May 15 would have been the best time this year, our season having been somewhat later than usual. By following the sprayer I found that ordinarily we did not get the calyx cup thoroughly drenched. Better results were obtained by making the spray rather coarser than we have heretofore used, and by spraying it with considerable force. It also seemed easier to get the poison into the cavities when they were wide open than when they had begun to close, making a vase-shaped receptacle, even though apparently leaving abundant opportunity for the entrance of the liquid. Then, too, the leaves increase in size very rapidly after the blossoms fall, and the work on this account is likely to be more thorough the sooner it is done. Were there no danger that the poison would be washed away by rains, the best time to apply it would be immediately after the blossoms fall.

It is very important to make sure that the calyx cups are well filled with poison, and it is quite evident that failure may result just at this point. Professor M. V. Slingerland says: 'Apples were then picked from a tree which had been sprayed just after the petals fell, and our chemist demonstrated that there was arsenic in the covered cup of the calyx.' On the other hand, the late Professor E. G. Lodeman, author of 'The Spraying of Plants,' and a recognized authority on the subject, in a letter written December 19, 1895, says: 'Neither do I believe that in ordinary spraying there is placed any appreciable amount of arsenic in the calyx basin. I have had many of these analyzed, and have never found even a trace of poison.' These comments are sufficient to show the need of care. Our observations show that only 75 or 80 per cent. of the larvae enter at this point. What, then, is to be the fate of the balance? The chances are nearly all against this spraying in any way affecting them. Of course, it may happen that now and then one will be poisoned where the liquid has been held between two apples or between a leaf and an apple. But we are fairly warranted in expecting this other twenty per cent. to get in their work and go on reproducing their kind throughout the balance of the season unless checked by some other means. With three or four generations a year, it will be seen that this percentage is amply sufficient to people our orchards and riddle our fruit before winter. The problem, then, as it presents itself to us, is how to circumvent the work of this remnant which we cannot control by ordinary spraying. Still another difficulty often appears by the proximity of a neighboring orchard which receives no care, and from which moths may drift across to reinforce the enemy upon our own grounds."

50—6—97

FARM WAGES; (SUMMER MONTHS).

Hand Employed for the Summer Months Only, with Board Furnished by the Employer.

	Minimum.	Maximum.	Average.
1877,	$12 00	$20 00	$16 25
1878,	12 00	18 75	15 25
1879,	11 00	16 75	14 50
1880,	11 75	21 50	16 75
1881,	11 50	21 00	17 25
1882,	12 00	22 50	17 25
1883,	12 25	22 25	17 00
1884,	14 25	23 00	17 75
1885,	13 75	22 75	17 75
1886,	12 00	22 00	17 75
1887,	12 00	20 00	16 00
1888,	11 00	20 00	16 35
1889,	12 00	24 00	17 50
1890,	11 00	24 00	17 67
1891,	12 00	24 00	17 57
1892,	12 50	22 00	16 70
1893,	12 00	25 00	17 20
1894,	11 50	23 50	17 10
1895,	12 50	25 00	16 60
1896,	12 00	22 00	16 28
1897,	11 00	22 00	16 25
Average,	$11 90	$22 95	$16 80

FARM WAGES; (WHOLE YEAR).

Hand Employed for the Whole Year, and Boarded by the Employer; Wages per Month.

	Minimum.	Maximum.	Average.
1877,	$8 33	$18 00	$13 25
1878,	8 50	15 00	11 25
1879,	8 00	14 50	11 00
1880,	8 75	19 75	12 00
1881,	10 50	16 00	13 25
1882,	9 50	19 50	13 70
1883,	9 75	19 75	14 00
1884,	11 50	20 25	14 00
1885,	12 25	19 50	14 10
1886,	9 50	16 50	13 07
1887,	10 00	20 00	13 07
1888,	8 50	18 50	12 90
1889,	8 50	18 50	13 15
1890,	9 50	20 00	14 25
1891,	10 00	10 00	14 37
1892,	9 50	18 00	14 05
1893,	10 00	20 00	13 50
1894,	9 50	18 50	13 00
1895,	10 00	18 00	12 09
1896,	9 00	16 50	12 78
1897,	9 00	20 00	12 75
Average,	$9 53	$18 37	$13 12

FARM WAGES AND BOARD, OCTOBER 1, 1897.

Counties.	By the month (whole year), with board.	By the month, for summer months only.	By the day, with regular work (with board).	By the day, with regular work (without board).	By the month (whole year), without board.	By the summer months (without board.)	By the day, for transient work, when wanted only.	Harvest wages, by the day.	Household help, female, with board, by the week.	Estimated cost of boarding farm hands per day.
Adams,	$10 00	$12 50	$0 65	$1 00	$13 50	$18 00	$0 75	$1 00	$1 65	$0 30
Allegheny,	12 50	15 00	1 00	1 25	15 00	20 00	1 00	1 50	2 25	45
Armstrong,	10 00	12 00	62	80	14 00	16 50	65	85	1 75	25
Beaver,	10 00	12 50	60	90	17 00	20 00	85	1 00	2 00	30
Bedford,	10 00	12 00	65	87	16 50	18 75	85	1 00	1 60	32
Berks,	11 50	14 00	75	1 00	17 00	19 00	75	1 00	1 75	27
Blair,	10 00	16 00	75	1 10	22 00	27 00	1 25	1 50	1 90	40
Bradford,	14 00	16 00	75	90	20 00	25 00	1 00	1 25	2 50	25
Bucks,	12 00	18 00	87	1 20	20 00	24 00	1 25	1 75	2 00	37
Butler,	11 00	16 00	75	1 10	20 00	25 00	1 25	1 37	1 75	35
Cambria,	10 00	15 00	60	90	20 00	25 00	60	80	2 50	30
Cameron,	14 00	17 00	80	1 10	18 50	25 00	90	1 25	2 25	37
Carbon,	12 00	16 00	75	1 00	20 00	25 00	1 00	1 25	2 00	30
Centre,	13 00	16 50	75	90	17 50	21 00	75	1 00	1 50	25
Chester,	12 00	15 00	75	1 20	20 00	24 00	1 25	1 40	2 00	25
Clarion,	10 00	16 00	1 00	1 25	20 00	26 00	1 20	1 25	2 00	25
Clearfield,	15 00	20 00	1 00	1 25	20 00	25 00	1 15	1 25	2 00	30
Clinton,	12 00	15 00	75	1 00	15 00	20 00	1 00	1 20	1 50	25
Columbia,	12 00	15 00	75	1 00	18 00	22 00	1 00	1 10	2 00	27
Crawford,	11 50	16 00	87	1 10	18 00	23 00	1 00	1 25	2 00	30
Cumberland,	10 50	15 50	75	1 00	18 00	22 00	90	1 00	1 87	30
Dauphin,	12 00	15 00	65	80	20 00	22 50	75	90	1 75	30
Delaware,	12 00	15 00	90	1 10	18 00	23 00	1 00	1 20	2 00	45
Elk,	20 00	25 00	1 00	1 25	22 00	30 00	1 50	1 75	2 50	37
Erie,	15 00	18 00	75	1 00	22 00	24 00	1 00	1 25	2 00	30
Fayette,	15 00	18 50	90	1 10	20 00	24 00	1 00	1 25	2 00	33
Forest,	14 00	18 00	85	1 10	20 00	25 00	1 00	1 35	1 75	35
Franklin,	10 00	13 00	65	85	17 50	21 00	1 00	1 25	1 25	25
Fulton,	8 00	10 00	50	75	11 00	15 00	60	1 00	1 25	25
Greene,	11 00	14 00	75	85	16 50	20 00	1 00	1 10	1 37	25
Huntingdon,	12 50	16 00	75	1 00	17 00	20 00	1 00	1 10	1 75	37
Indiana,	12 00	15 00	87	1 00	20 00	24 00	90	1 00	1 50	35
Jefferson,	12 00	14 00	70	1 00	17 00	20 00	1 00	1 20	2 25	33
Juniata,	8 50	11 50	50	75	12 50	16 50	1 00	1 25	1 50	30
Lackawanna,	13 00	15 00	1 00	1 25	25 00	28 00	1 25	1 50	2 00	30
Lancaster,	12 50	16 50	80	1 00	20 00	25 00	1 00	1 25	2 00	30
Lawrence,	11 00	13 00	60	75	17 00	20 00	75	1 00	1 50	33
Lebanon,	12 00	15 00	65	90	15 00	20 00	75	1 10	2 00	30
Lehigh,	10 50	13 00	75	1 00	15 00	18 00	75	1 00	1 75	35
Luzerne,	15 00	18 00	80	1 25	25 00	30 00	1 25	1 50	2 00	33
Lycoming,	11 00	16 00	75	1 00	15 00	21 00	1 00	1 20	2 00	30
McKean,	15 00	19 00	90	1 25	20 00	27 00	1 25	1 50	2 00	30
Mercer,	14 00	18 00	1 00	1 12	20 00	24 00	1 00	1 25	2 00	24
Mifflin,	9 00	12 00	50	75	14 50	18 00	75	1 00	1 25	25
Monroe,	12 00	15 00	65	1 00	20 00	25 00	1 10	1 25	2 50	32
Montgomery,	12 00	16 00	80	1 00	20 00	25 00	1 00	1 20	1 75	25
Montour,	10 00	12 00	75	85	20 00	24 00	75	1 10	2 00	33
Northampton,	10 00	12 50	1 00	1 20	18 00	23 00	1 20	1 25	2 00	35
Northumberland,	11 00	14 00	75	1 00	15 00	18 00	75	1 00	2 00	37
Perry,	9 00	12 00	60	75	12 00	16 00	60	75	1 50	25
Philadelphia,	17 00	21 00	1 00	1 40	25 00	30 00	1 00	1 50	2 00	50
Pike,	13 00	18 00	1 00	1 25	14 00	18 00	1 10	1 25	2 50	40
Potter,	12 00	15 00	1 00	1 25	18 00	20 00	1 00	1 10	1 50	30
Schuylkill,	12 50	18 00	75	1 00	24 00	30 00	1 25	1 50	2 00	25
Snyder,	10 00	15 00	75	1 00	12 50	17 00	75	1 00	1 50	35
Somerset,	12 00	15 00	80	1 00	18 00	24 00	90	1 00	2 00	35
Sullivan,	15 00	20 00	75	1 00	20 00	25 00	1 10	1 25	2 00	25
Susquehanna,	12 00	16 00	75	1 00	15 00	20 00	85	1 25	2 50	30
Tioga,	16 00	18 00	75	1 00	20 00	24 00	1 00	1 25	2 00	27
Union,	11 00	14 00	75	1 00	16 00	20 00	1 00	1 10	1 75	30
Venango,	11 00	14 00	75	1 20	17 00	20 00	1 00	1 20	2 00	45
Warren,	14 00	16 00	75	1 00	20 00	22 50	1 00	1 50	2 00	35
Washington,	14 00	16 00	75	1 00	18 00	22 00	1 00	1 25	2 00	33
Wayne,	15 00	18 00	75	1 20	27 00	33 00	1 25	1 50	2 00	35
Westmoreland,	11 00	15 00	67	1 00	18 00	24 00	1 00	1 25	2 25	40
Wyoming,	12 00	15 50	75	1 00	16 50	22 00	1 00	1 25	1 75	33
York,	10 00	12 50	60	85	16 00	20 00	90	1 25	1 50	32

PRICES OF FARM PRODUCTS, OCTOBER 1, 1897.

Counties.	Wheat, per bushel.	Corn per bushel (shelled).	Corn, per bushel, in the ear.	Oats, per bushel.	Potatoes, per bushel.	Hay, clover, per ton.	Hay, timothy, per ton.	Butter, per pound, (average), at store.	Butter, per pound, (average), at market.
Adams,	$0 95	$0 32	$0 32	$0 20	$0 50	$5 00	$7 50	$0 12	$0 15
Allegheny,	89	37	38	25	80	8 00	10 00	15	22
Armstrong,	90	45	50	30	50	6 00	8 00	12	15
Beaver,	90	40	37	30	60	7 75	9 50	16	18
Bedford,	92	40	40	28	50	6 00	8 00	12	15
Berks,	95	38	35	30	60	10 00	11 00	17	20
Blair,	85	40	40	32	50	10 06	12 00	21	23
Bradford,	1 00	40	35	25	48	7 00	9 00	18	20
Bucks,	1 00	43	42	30	70	7 00	9 00	18	22
Butler,	90	42	37	30	65	8 00	10 00	16	18
Cambria,	90	40	35	25	55	7 50	8 50	16	20
Cameron,	95	45	40	32	75	8 50	10 00	16	18
Carbon,	1 00	40	28	28	75	10 00	12 00	20	24
Centre,	95	37	37	25	65	7 50	10 00	16	18
Chester,	93	38	36	28	55	9 50	10 50	23	25
Clarion,	90	40	38	25	40	8 00	10 00	15	15
Clearfield,	90	50	40	32	50	8 00	10 50	20	20
Clinton,	95	40	40	30	65	8 00	10 00	15	18
Columbia,	92	37	35	27	65	9 00	10 00	18	20
Crawford,	1 00	50	40	25	65	6 00	7 00	16	18
Cumberland,	92	32	40	20	55	7 00	9 50	14	18
Dauphin,	1 00	40	38	30	50	10 00	15 00	14	18
Delaware,	85	40	35	30	75	10 00	12 00	20	22
Elk,	1 00	35	33	25	90	10 00	12 00	20	23
Erie,	1 00	40	35	25	60	5 00	6 00	18	20
Fayette,	92	30	30	24	50	7 00	9 00	15	16
Forest,	90	35	33	25	50	6 00	7 00	12	14
Franklin,	90	37	34	25	50	7 00	8 00	12	15
Fulton,	90	32	30	25	50	7 00	9 00	12	14
Greene,	88	35	34	25	45	6 50	8 00	14	18
Huntingdon,	95	40	35	25	50	8 00	10 00	18	20
Indiana,	85	45	40	30	60	7 00	9 50	14	16
Jefferson,	1 00	45	40	25	55	7 00	9 00	14	16
Juniata,	90	30	25	22	70	6 00	8 00	14	15
Lackawanna,	1 00	40	35	32	80	10 00	12 00	16	18
Lancaster,	95	40	37	27	65	10 00	12 00	15	13
Lawrence,	90	40	35	22	66	7 00	9 00	18	22
Lebanon,	96	34	30	25	50	9 00	11 00	18	20
Lehigh,	1 00	37	35	25	50	10 00	12 00	16	18
Luzerne,	1 00	40	38	25	75	10 00	15 00	18	22
Lycoming,	95	35	30	24	50	9 00	10 00	16	20
McKean,	1 00	40	35	28	60	7 00	8 00	13	20
Mercer,	90	33	35	25	60	6 00	7 00	15	18
Mifflin,	90	30	28	23	65	7 00	10 00	14	17
Monroe,	90	35	30	28	60	10 00	12 00	15	18
Montgomery,	97	48	45	32	65	7 00	10 00	20	24
Montour,	96	36	30	22	50	8 00	10 00	14	18
Northampton,	1 03	43	40	32	55	11 00	13 00	14	16
Northumberland,	95	36	32	22	60	7 00	10 00	18	20
Perry,	90	40	35	20	60	8 00	10 00	10	12
Philadelphia,	1 00	45	40	25	75	10 00	12 00	18	22
Pike,	1 00	50	45	32	80	10 00	11 00	18	20
Potter,	1 00	48	44	25	75	8 00	10 00	14	16
Schuylkill,	1 00	45	40	23	62	9 00	13 00	20	22
Snyder,	85	37	35	22	50	8 00	10 00	18	20
Somerset,	95	40	37	28	50	8 00	10 00	14	18
Sullivan,	75	40	36	25	60	6 00	8 00	12	14
Susquehanna,	1 05	40	35	35	50	8 00	10 00	16	20
Tioga,	1 00	40	37	25	60	5 00	7 00	12	15
Union,	95	35	30	20	65	9 00	11 00	12	15
Venango,	1 00	38	35	27	50	7 50	9 50	15	18
Warren,	1 00	50	45	27	75	7 00	9 00	14	16
Washington,	85	35	32	28	55	8 00	10 00	20	25
Wayne,	1 00	45	40	32	65	8 00	10 00	15	18
Westmoreland,	85	37	35	26	77	6 00	8 00	18	20
Wyoming,	85	35	30	28	70	6 50	9 00	16	18
York,	95	35	30	24	55	8 00	10 00	14	17

VALUE OF LIVE STOCK, OCTOBER 1, 1897.

Counties.	Ewes, average, per head.	Lambs, average, per head.	Horses, average, per head.	Mules, average, per head.	Cows, average, per head.	Chickens, dressed, per pound.	Chickens, live, per pound.	Average condition of live stock, per cent.
Adams,	$4 00	$2 75	$65 00	$60 00	$25 00	$0 10	$0 08	77
Allegheny,	4 00	3 00	75 00	70 00	37 50	13	10	90
Armstrong,	3 00	2 25	47 50	45 00	35 00	10	07	75
Beaver,	3 00	2 75	70 00	67 00	32 00	10	08	90
Bedford,	3 00	2 50	40 00	40 00	25 00	10	08	100
Berks,	3 50	2 75	65 00	75 00	35 00	11	08	90
Blair,	3 50	3 00	60 00	75 00	35 00	14	10	80
Bradford,	3 50	3 25	80 00	70 00	28 50	10	08	110
Bucks,	4 50	4 00	80 00	75 00	40 00	12	10	97
Butler,	3 00	2 50	70 00	60 00	30 00	10	08	100
Cambria,	2 00	2 00	40 00	50 00	22 00	10	08	100
Cameron,	3 00	2 75	60 00	60 00	28 00	10	08	95
Carbon,	3 00	2 50	75 00	80 00	25 00	12	10	110
Centre,	3 00	3 00	55 00	60 00	28 00	09	06	100
Chester,	3 75	3 50	70 00	67 00	37 00	12	09	100
Clarion,	2 50	2 50	50 00	50 00	25 00	10	06	90
Clearfield,	2 50	2 00	65 00	55 00	30 00	10	07	115
Clinton,	3 00	3 00	50 00	50 00	26 00	08	06	100
Columbia,	3 50	4 00	40 00	40 00	25 00	10	08	100
Crawford,	4 00	3 00	40 00	40 00	25 00	12	07	100
Cumberland,	3 00	3 25	70 00	62 00	30 00	10	08	100
Dauphin,	4 50	3 50	75 00	95 00	35 00	10	08	90
Delaware,	4 00	3 50	65 00	70 00	35 00	12	10	75
Elk,	4 00	3 25	90 00	75 00	37 00	12	10	100
Erie,	3 00	3 00	50 00	50 00	25 00	12	08	90
Fayette,	3 50	3 00	65 00	65 00	27 50	10	08	90
Forest,	3 00	2 50	70 00	67 00	28 00	10	08	90
Franklin,	3 25	2 75	65 00	65 00	30 00	10	07	90
Fulton,	2 50	3 00	37 50	45 00	25 00	10	06	100
Greene,	3 50	2 25	40 00	50 00	30 00	09	06	120
Huntingdon,	3 00	2 50	62 50	62 50	28 00	12	10	100
Indiana,	3 70	2 80	60 00	70 00	29 00	10	06	100
Jefferson,	3 00	3 00	50 00	50 00	27 00	11	07	100
Juniata,	3 00	3 00	50 00	50 00	30 00	08	06	100
Lackawanna,	4 00	2 75	50 00	75 00	25 00	12	10	90
Lancaster,	3 75	3 25	100 00	90 00	40 00	12	10	90
Lawrence,	3 50	3 00	50 00	50 00	35 00	12	08	90
Lebanon,	3 50	3 00	62 00	60 00	40 00	12	08	100
Lehigh,	3 00	3 70	75 00	60 00	30 00	12	08	80
Luzerne,	4 50	3 00	75 00	75 00	35 00	12	10	95
Lycoming,	3 00	2 25	62 50	60 00	28 00	12	08	95
McKean,	3 00	2 50	45 00	40 00	32 00	12	09	90
Mercer,	4 00	3 25	60 00	50 00	35 00	10	08	95
Mifflin,	3 50	3 00	50 00	55 00	27 50	09	07	100
Monroe,	2 75	2 75	50 00	60 00	30 00	09	06	110
Montgomery,	3 00	3 50	65 00	75 00	40 00	14	10	110
Montour,	3 00	3 00	70 00	80 00	30 00	11	08	96
Northampton,	5 00	3 00	70 00	75 00	32 50	10	08	106
Northumberland,	3 00	2 50	55 00	65 00	30 00	12	08	98
Perry,	3 25	2 75	58 00	62 50	30 00	11	09	96
Philadelphia,	3 25	4 00	80 00	70 00	32 50	12	10	95
Pike,	3 50	3 50	40 00	50 00	25 00	13	10	100
Potter,	2 75	3 00	70 00	67 00	25 00	08	06	90
Schuylkill,	3 00	2 25	80 00	75 00	30 00	12	08	110
Snyder,	3 50	2 50	70 00	70 00	30 00	09	07	90
Somerset,	3 25	3 75	55 00	65 00	27 50	08	06	95
Sullivan,	3 00	2 50	50 00	50 00	25 00	11	08	85
Susquehanna,	4 00	3 50	50 00	55 00	28 00	10	08	75
Tioga,	3 25	3 00	50 00	60 00	26 00	10	08	97
Union,	3 00	3 00	65 00	75 00	30 00	11	08	85
Venango,	3 00	2 75	50 00	50 00	27 50	10	08	100
Warren,	3 25	3 00	45 00	50 00	30 00	10	07	100
Washington,	2 75	2 25	45 00	55 00	25 00	12	08	90
Wayne,	3 75	3 50	65 00	70 00	27 50	11	08	95
Westmoreland,	3 00	3 00	75 00	75 00	27 00	12	08	95
Wyoming,	3 25	2 50	60 00	60 00	28 50	10	08	90
York,	3 00	2 50	60 00	75 00	25 00	10	07	100

LIST OF COUNTY AND LOCAL AGRICULTURAL SOCIETIES.

With Names and Addresses of Secretaries and Dates for Holding Fall Exhibitions of 1897; compiled from official reports and sources by the Pennsylvania Department of Agriculture.

[Those marked with an * are represented in the Board of Agriculture by elected members.]

COUNTY.	Corporate Name of Society.	Name and Address of Secretary.	Where Held.	When Held.
	PENNSYLVANIA STATE AGRICULTURAL SOCIETY,	H. C. Demming, Harrisburg,	Johnstown,	Sept. 6-11.
	STATE HORTICULTURAL ASSOCIATION,	Cyrus T. Fox, Reading,	Williams' Grove,	No fair.
	GRANGERS' INTERSTATE EXPOSITION,	R. H. Thomas, Mechanicsburg,	Williams' Grove,	Aug. 23-28.
	MT. GRETNA AGRIC'L, MECHANICAL AND INDUST'L EX.,	Dr. S. P. Heilman, Heilmansdale,	Mt. Gretna,	Aug. 16-20.
	PATRONS OF HUSBANDRY EXHIBITION,	L. Rhone, Centre Hall,	Centre Hall,	Sept. 13-18.
	PENNSYLVANIA STATE DAIRYMEN'S ASSOCIATION,	G. H. St. John, Meadville,		No fair.
Adams,*	Adams County Agricultural Association,	D. Toot, Table Rock,		No fair.
Allegheny,*	Tarentum Fair Association,	J. C. Dunn, Tarentum,	Tarentum,	Aug. 31, Sept. 3.
Armstrong,*	Dayton Agricultural and Mechanical Association,	W. C. Marshall, Dayton,	Dayton,	Sept. 28, Oct. 1.
Do.	Parker Agricultural Association,	Isaac Miller, Parker's Landing,	Parker's Landing,	Sept. 14-17.
Do.	Kittanning Fair Association,	T. McConnell, Kittanning,	Kittanning,	Aug. 24-27.
Beaver,*	Beaver County Agricultural Society,	S. S. Darragh, Beaver,	Beaver,	Sept. 21-24.
Do.	Mill Creek Valley Agricultural Society,	R. M. Swaney, Hookstown,	Hookstown,	Aug. 24-26.
Bedford,*	Bedford County Agricultural Society,	J. F. Mickel, Bedford,	Bedford,	Oct. 5-8.
Berks,*	Berks County Agricultural and Horticultural Society,	Cyrus T. Fox, Reading,	Reading,	Sept. 7-10.
Do.	Keystone Agricultural Society,	J. B. Esser, Kutztown,	Kutztown,	Sept. 28, Oct. 1.
Blair,*	Blair County Agricultural Society,	C. H. Porter, Hollidaysburg,	Hollidaysburg,	Sept. 14-17.
Bradford,*	Bradford County Agricultural Society,	Benj. Kuykendall, Jr., Tow'a,	Towanda,	Sept. 21-24.
Do.	Union Agricultural Association,	C. D. Derrah, Canton,	Canton,	Sept. 4-9.
Do.	Troy Farmers' Club,	N. A. Maynard, Troy,	Troy,	No fair.
Butler,*	Butler County Agricultural Society,	W. P. Roessing, Butler,	Butler,	Sept. 7-10.
Cambria,*	Cambria County Agricultural Association,	J. V. Mancher, Carrolltown,	Carrolltown,	Sept. 21-24.
Cameron,*	Cameron County Agricultural Association,	H. G. Lyons, Emporium,		No fair.
Carbon,	Carbon County Industrial Society,	C. W. Bower, Lehighton,	Lehighton,	Sept. 28, Oct. 1.
Centre,*	Centre County Agricultural Society,	John Kline, Howard,	Bellefonte,	No fair.
Chester,*	Chester County Agricultural Society,	B. Lear, West Chester,	West Chester,	No fair.
Do.	Oxford Agricultural Society,	H. C. Thomas, Oxford,	Oxford,	Sept. 22-24.
Clarion,*	Clarion County Fair Association,	S. S. Laughlin, Oxford,	Clarion,	Sept. 21-24.
Clearfield,*	Clearfield County Agricultural Society,	R. P. Kester, Grampian,	Grampian,	Sept. 28, Oct. 1.
Clinton,*	Clinton County Agricultural Society,	J. R. Porter, Mackeyville,		No fair.
Columbia,*	Columbia County Agricultural Society,	A. N. Yost, Bloomsburg,	Bloomsburg,	Oct. 13-16.

LIST OF COUNTY AND LOCAL AGRICULTURAL SOCIETIES.—Continued.

COUNTY.	Corporate Name of Society.	Name and Address of Secretary.	Where Held.	When Held.
Columbia,	Northern Columbia and Southern Luzerne Agricultural Society,	J. W. Evans, Berwick,	Berwick,	No fair.
Crawford,*	Crawford County Agricultural Society,	F. L. Lord, Conneautville,	Conneautville,	Sept. 7-10.
Do.	Cochranton Agricultural Society,	John H. Adams, Cochranton,	Cochranton,	Sept. 15-17.
Do.	Oil Creek Valley Agricultural Association,	C. M. Hayes, Titusville,	Titusville,	No fair.
Do.	Central Crawford Agricultural Society,	A. S. Faber, Cambridge,	Cambridgeboro',	Sept. 21-24.
Cumberland,*	Cumberland County Agricultural Society,	W. H. McCrea, Carlisle,	Carlisle,	Sept. 28, Oct. 1.
Dauphin,	Gratz Driving Park and Agricultural Society,	J. W. Hoffman, Gratz,	Gratz,	Aug. 24-27.
Do.*	Agricultural Society of Dauphin County,	G. Hiester, Harrisburg,		No fair.
Do.	Lykens Driving Park and Agricultural Society,	A. C. Long, Lykens,	Lykens,	No fair.
Delaware,*	Delaware County Agricultural Society,	Joseph H. Paschall, Wawa,		No fair.
Erie,*	Northwestern Agricultural Society,	T. W. Pope, Corry,	Corry,	Aug. 31, Sept. 3.
Do.	Wattsburg Agricultural Society,	A. S. Phelps, Wattsburg,	Wattsburg,	Sept. 7-10.
Do.	Edinboro Agricultural Society,	H. L. Cooper, Edinboro',	Edinboro',	Sept. 14-17.
Fayette,*	Fayette County Agricultural Association,	W. W. Parshall, Uniontown,	Uniontown,	Sept. 1-3.
Franklin,*	Franklin County Farmers' Association,	D. Z. Shook, Greencastle,		No fair.
Fulton,*	Big Cove Agricultural Society,	M. M. Kendall, McConnellsb'g,	McConnellsburg,	No fair.
Greene,	Greene County Agricultural and Mechanical Society,	L. W. Gwynn, Carmichaels,	Carmichaels,	Sept. 29-30.
Do.*	Greene County Agricultural and Horticultural Society,	J. R. Pipes, Waynesburg,	Waynesburg,	No fair.
Do.	Waynesburg Fair Association,	T. S. Crago, Waynesburg,	Waynesburg,	Sept. 21-23.
Huntingdon,*	Huntingdon County Agricultural Society,	W. A. Neff, Warrior's Mark,		No fair.
Indiana,*	Indiana County Agricultural Society,	Geo. J. Felt, Indiana,	Indiana,	Sept. 14-17.
Jefferson,*	Jefferson County Agricultural Society,	C. S. Irwin, Brookville,	Brookville,	No report.
Do.	Punxsutawney Agricultural Society,	D. M. McQuown, Punxsutaw'y,	Punxsutawney,	No fair.
Juniata,*	Juniata County Agricultural Society,	W. R. Wharton, Port Royal,	Port Royal,	Sept. 15-17.
Lackawanna,*	North Abington and Glenburn Farmers' Club,	Isaac Ellis, Glenburn,	Glenburn,	No fair.
Do.	North Lackawanna Farmers' Association,	J. L. Stone, Waverly,	Waverly,	No fair.
Lancaster,*	Lancaster County Agricultural Society,	F. R. Diffenderffer, Lancaster,	Lancaster,	No fair.
Do.	Warwick Driving Park Association,	H. H. Snavely, Lititz,	Lititz,	Sept. 1-4.
Lawrence,*	Lawrence County Agricultural Society,	H. W. Grigsby, New Castle,	New Castle,	Aug. 31, Sept. 3.
Lebanon,*	Lebanon Agricultural and Horticultural Society,	W. R. Woelfly, Jonestown,	Lebanon,	No fair.
Lehigh,*	Lehigh County Agricultural Society,	W. K. Mohr, Allentown,	Allentown,	Sept. 20-24.
Luzerne,*	Dallas Union Agricultural Association,	J. H. Anderson, Dallas,	Dallas,	Sept. 29, Oct. 2.
Lycoming,*	Muncy Valley Farmers' Club,	A. C. Henry, Hughesville,	Hughesville,	Sept. 29, Oct. 2.
McKean,	McKean County Agricultural Society,	C. W. Catlin, Port Allegheny,	Port Allegheny,	No fair.
Do.*	Agricultural and Breeders' Society,	James Quirk, East Smethport,		No fair.
Mercer,	Mercer County Agricultural Society,	Geo. H. Fowler, Stoneboro',	Stoneboro',	Sept. 21-23.
Do.*	Mercer Central Agricultural Society,	J. P. Orr, Mercer,	Mercer,	Sept. 28-30.
Mifflin,*	Mifflin County Agricultural Society,	A. T. Hamilton, Lewistown,	Lewistown,	No fair.
Monroe,*	Monroe County Agricultural Society,	T. C. Brown, Stroudsburg,	Stroudsburg,	Sept. 7-11.
Montgomery,*	Montgomery, Berks and Chester Agricultural Society,	E. P. Ancona, Pottstown,	Pottstown,	No fair.

Montour,*	Montour County Agricultural Society,	W. K. West, Danville,	Danville,	No report.
Northampton,*	Northampton County Agricultural Society,	J. J. Maus, Nazareth,	Nazareth,	Oct. 5-8.
Do.	Farmers' and Mechanics' Institute,	Thomas A. Hay, Easton,	Easton,	No fair.
Do.	Bethlehem Fair and Driving Park Association,	H. A. Gorman, Bethlehem,	Bethlehem,	Sept. 14-17.
Northumberland,*	Milton Driving Park and Fair Association,	W. P. Hastings, Milton,	Milton,	Oct. 5-8.
Perry,*	Perry County Agricultural Society,	F. A. Fry, Newport,	Newport,	Sept. 22-24.
Philadelphia,*	Pennsylvania Horticultural Society,	David Rust, Philadelphia,	Philadelphia,	Nov. 9-13.
Potter,*	Potter County Agricultural and Horticultural Society,	C. L. Peck, Coudersport,	Coudersport,	Sept. 7-10.
Do.	Farmers' and Breeders' Association,	D. S. Lisbert, Coudersport,		No report.
Schuylkill,*	Orwigsburg Agricultural Society,	A. C. Eisenhuth, Orwigsburg,	Orwigsburg,	Aug. 31, Sept. 3.
Do.	Ringtown Agricultural Society,	L. Applegate, Shenandoah,	Ringtown,	No fair.
Snyder,*	Snyder County Agricultural Association,	G. S. Snyder, Middleburg,		No fair.
Somerset,*	Somerset County Agricultural Society,	H. J. Hoffman, Somerset,		No fair.
Sullivan,*	Sullivan County Agricultural Society,	M. R. Black, Forksville,	Forksville,	Oct. 6-8.
Susquehanna,*	Susquehanna County Agricultural Society,	W. A. Titsworth, Montrose,	Montrose,	Oct. 5-6.
Do.	Harford Agricultural Society,	E. E. Jones, Harford,	Harford,	Sept. 29-30.
Tioga,	Cowanesque Valley Agricultural Society,	C. C. Williams, Westfield,	Westfield,	Sept. 14-17.
Do.*	Smythe Park Association,	J. A. Elliott, Mansfield,	Mansfield,	Sept. 21-24.
Do.	Tioga County Pomona Grange,	H. Robylyre, Balsam,	Wellsboro',	Sept. 1-3.
Union,*	Union County Agricultural Society,	C. Dale Wolfe, Lewisburg,	Lewisburg,	Sept. 29, Oct. 1.
Venango,*	Venango County Agricultural Society,	James Miller, Franklin,	Franklin,	No fair.
Warren,*	Warren County Fair Association,	Willis Cowan, Warren,	Warren,	Sept. 14-17.
Washington,*	Western Pennsylvania Agricultural Association,	J. LeMoyne, Washington,	Washington,	Sept. 15-17.
Do.	Union Agricultural Association,	Wm. Melvin, S. Burgettstown,	Burgettstown,	Oct. 5-7.
Wayne,*	Wayne County Agricultural Society,	W. A. Gaylord, Honesdale,	Honesdale,	Sept. 28-30.
Westmoreland,*	Westmoreland Agricultural Society,	W. F. Holtzer, Greensburg,	Greensburg,	Sept. 21-24.
Wyoming,*	Wyoming County Agricultural Society,	W. N. Reynolds, Tunkhannock,	Tunkhannock,	Sept. 15-17.
York,*	York County Agricultural Society,	E. Chapin, York,	York,	Oct. 4-8.
Do.	Hanover Agricultural Society,	M. O. Smith, Hanover,	Hanover,	Sept. 7-10.

COMMONWEALTH OF PENNSYLVANIA.

DEPARTMENT OF AGRICULTURE.

TABULATED ANALYSES

OF

COMMERCIAL FERTITIZERS

FROM

SAMPLES SELECTED IN ACCORDANCE WITH ACT OF JUNE 28, 1889,

BY THE

Pennsylvania Department of Agriculture,

FROM AUGUST 1st, 1897, TO JANUARY 1st, 1898,

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA.
1898.

AN ACT

To regulate the manufacture and sale of commercial fertilizers.

Section 1. *Be it enacted, &c.*, That every package of commercial fertilizer sold, offered or exposed for sale for manurial purposes within this Commonwealth, shall have plainly stamped thereon the name of the manufacturer, the place of manufacture, the net weight of its contents, and an analysis stating the percentage therein contained of nitrogen, or its equivalent in ammonia, in an available form, of potash soluble in water, of soluble and reverted phosphoric acid, and of insoluble phosphoric acid: *Provided*, That any commercial fertilizer sold, offered or exposed for sale which shall contain none of the above named constituents shall be exempt from the provisions of this act.

Section 2. Every manufacturer or importer of commercial fertilizers as specified in section one of this act, shall on or before the first day of January, next ensuing, or before offering them for sale in this Commonwealth, file annually with the Secretary of the State Board of Agriculture, an affidavit showing the amount of said fertilizer sold within the Commonwealth during the last preceding year, and if the said amount shall be one hundred tons or less, he shall pay to the Treasurer of the State the sum of ten dollars for each and every article of such commercial fertilizer sold within the State during the last preceding year, and if the said amount shall exceed one hundred tons and be less than five hundred tons, he or they shall pay the sum of twenty dollars as aforesaid, and if the said amount shall be five hundred tons or more, he or they shall pay the sum of thirty dollars as aforesaid. If such manufacturer or manufacturers, importer or importers, shall not have made any sales within the Commonwealth during the preceding year, he or they shall pay the sum of ten dollars as aforesaid. Every such manufacturer shall at the same time file with the Secretary of the State Board of Agriculture, a copy of the analysis required by section one of this act, and shall then be entitled to receive from the Secretary of the State Board of Agriculture, a certificate showing that the provisions of this act have been complied with: *Provided*, That the certificates which have been issued for the year ending July thirty-first, one thousand eight hundred and ninety-five, are hereby extended until the thirty-first day of December, one thousand eight hundred and ninety-five. (*As amended by act, June 26, 1895.*)

Section 3. Any person selling, offering or exposing for sale any commercial fertilizer without the analysis required by section one of this act, or with an analysis stating that it contains a larger percentage of any or more of the above named constituents than is contained therein, or for the sale of which all the provisions of section two have not been complied with, shall be guilty of a misdemeanor, and on conviction, shall forfeit a sum not less than twenty-five and not exceeding one hundred dollars for the first offense, and not less than two hundred dollars for each subsequent offense, one-half of which shall be for the use of the informer, and the remainder for the county in which the conviction is secured: *Provided*, Said informer be the purchaser and goods be for his own use.

Section 4. It shall be the duty of the Board of Agriculture to analyze such specimens of commercial fertilizers as may be furnished by its agents, said samples to be accompanied with proper proof, under oath or affirmation, that they were fairly drawn; the fee for such analysis shall be determined by the executive committee of the Board, and be based upon a fixed rate for each determination, and shall in no case exceed seventy-five per centum of the usual price paid for such services, and shall be payable from the Treasury of the Commonwealth in the manner as now provided by law.

Section 5. That the money paid into the treasury under the provisions of this act shall constitute a special fund from which the cost of selecting samples, making analyses and other expenses incident to the carrying into effect the provisions of this act shall be paid: *Provided*, That the total amount thus expended shall in no case exceed the amount paid into the Treasury. (*As amended by act*, *May 21*, *1895*.)

Section 6. The term "commercial fertilizers," as used in this act, shall be taken to mean any and every substance imported, manufactured, prepared, or sold for fertilizing or manuring purposes, except barnyard manure, marl, lime, and wood ashes, and not exempt by the provisions of section one of this act.

Section 7. This act shall go into effect on and after the first day of August, one thousand eight hundred and seventy-nine.

APPROVED:—June 28, 1879

NOTE.

VALUATIONS.

DEPARTMENT OF AGRICULTURE,
HARRISBURG, PA., January 1, 1898.

While the Department recognizes the desirability of retaining the same schedule of valuations as long as possible, it was found that, during the years 1895 and 1896, the decrease in the prices of fertilizer materials was such as rendered the schedule adopted too high, and as a natural result the "Commercial Values" of nearly all brands of fertilizers exceeded their "selling price at the point of selection."

In order to remedy this difficulty and restore the balance between "commercial value" and "selling price," Dr. William Frear, Chemist of the Department, recommended a new schedule of values, which was adopted for the list of tabulated analyses of samples selected from January 1, 1897 to August 1, 1897. This schedule has been continued, and is made use of in establishing the valuations of this list, and the figures upon which the valuations are based is inserted below.

Respectfully yours,
THOS. J. EDGE,
Secretary, &c.

SCHEDULE OF VALUES FOR FERTILIZER INGREDIENTS, 1897.

	Cents per pound.
Nitrogen, in ammonia salts,	13½
in nitrates,	14
In dry and fine ground fish, meat and blood, and in mixed fertilizers,	14
in cotton seed meal and castor pomace,	12
in fine bone and tankage,	10
in medium bone and tankage,	9
in coarse bone and tankage,	7

Phosphoric acid, soluble in water, in bone fertilizers, ...	5½
soluble in water, in rock fertilizers, ...	3
soluble in ammonium citrate, in bone fertilizers, ...	5
soluble in ammonium citrate, in rock fertilizers, ...	2½
insoluble in ammonium citrate, in bone fertilizers, ...	2
insoluble in ammonium citrate, in rock fertilizers, ...	1½
Phosphoric acid in fine bone, tankage and fish, ...	3½
in medium bone and tankage, ...	2½
in coarse bone and tankage, ...	2
acid, in fine ground fish, cotton seed meal, castor pomace and wood ashes, ...	4½
Potash in high grade sulphate and in forms free from muriate (or chloride), ...	5
as muriate, ...	4½

Potash in excess of that equivalent to the chlorine present, will be valued as sulphate, and the remainder as muriate.

Nitrogen in mixed fertilizers will be valued as derived from the best sources of organic nitrogen, unless clear evidence to the contrary is obtained.

Phosphoric acid in mixed fertilizers is valued at bone phosphoric acid prices unless clearly found to be derived from rock phosphate.

Ground Bone is sifted into three grades of the following fineness: Fine, less than 1-50 inch; medium, less than 1-25 inch; coarse, over 1-25 inch.

The result obtained by the use of these valuations does not cover the items of mixing, bagging, freight and agents' commissions. To cover these, allowances are made as follows:

For freight, an allowance of $2.00 per ton on all fertilizers.

For bagging, an allowance of $1.00 per ton on all fertilizers.

For mixing, an allowance of $1.00 per ton for complete fertilizers, and rock and potash goods.

For agents' commissions, an allowance of 20 per cent. is added to the cash value of the goods ready for shipment.

NOTE.—On account of the unusually large number of analyses of samples of fertilizers which were made during 1897, it is regretted that we can only find space in this report for those made for the period covering August 1, 1897, to January 1, 1898.

SECRETARY.

TABULATED ANALYSES OF COMMERCIAL FERTILIZERS.

From samples selected by the Secretary and Special Agents of the Pennsylvania Department of Agriculture. Analyses by DR. WILLIAM FREAR, *Chemist of the Department, and of the State College Experiment Station, State College, Pa.*

Samples Selected from August 1, 1897 to January 1, 1898.

COMPLETE FERTILIZERS.

Containing Phosphoric Acid, Potash and Nitrogen.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
805	American Reduction Co., Pittsburg, Pa.,	Pouter Brand,	Carrolltown,	5.62	6.07	2.58	0.95	2.23	1.44	$23 49	$22 00	805
806	" " " "	Pouter General Phosphate,	Carrolltown,	4.86	2.58	1.77	4.42	2.08	1.82	20 85	23 00	806
807	" " " "	Common Sense,	Carrolltown,	6.62	2.28	1.63	0.51	0.92	1.94	17 12	17 00	807
874	" " " "	Pouter Brand,	Circleville,	4.50	3.94	2.05	2.75	2.19	1.75	21 78	24 00	874
1492	" " " "	Special Potato Fertilizer,	Mt. Chestnut,	4.61	0.42	1.01	0.64	8.19	2.84	25 76	30 00	1492
555	Armour Fertilizer Works, Chicago, Ill.,	Ammon'ted Bone with Potash,	Somerset,	3.71	1.70	4.51	3.99	1.44	2.88	25 45	25 00	555
993	" " " "	Blood, Bone and Potash,	Bellefonte,	4.33	6.56	3.00	1.31	7.57	4.85	42 63	43 00	993
996	" " " "	All Soluble,	Bellefonte,	2.77	2.33	5.37	4.78	5.09	3.03	32 60	36 00	996

COMPLETE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1354	Armour Fertilizer Works, Chicago, Ill., ..	Grain Grower, ...	Ellwood City, ...	4.27	6.23	4.52	5.19	2.29	2.68	32 11	25 00	1354
952	R. S. Aucker, Shamokin, Pa., ...	Grade B., Bone & Sl'ter House,	Snydertown, ...	6.11	3.93	4.07	1.77	3.53	1.23	23 36	21 00	952
953	" " "	Grade C., Bone & Sl'ter House,	Snydertown, ...	8.02	5.46	3.32	1.43	3.11	0.89	22 63	20 00	953
955	" " "	Grade A., Bone & Sl'ter House,	Snydertown, ...	7.07	3.98	5.72	1.91	3.29	1.74	26 88	23 00	955
824	Baltimore Guano Co., Baltimore, Md., ...	Baltimore Sp'l Wheat Mixture,	Johnstown, ...	7.97	4.94	4.75	1.82	2.41	1.14	23 96	26 00	824
826	" " " "	Baltimore Special, ...	Johnstown, ...	8.27	5.39	5.33	1.38	2.09	1.12	24 56	26 00	826
891	" " " "	B. & G. Ammoniated Phos., ..	Dutra Station, ...	6.88	8.79	0.11	2.65	2.15	1.50	24 73	24 00	891
1341	" " " "	Sp'l Wheat, Corn & Grass Mix.,	Everett, ...	5.63	5.31	4.25	2.42	2.40	1.10	23 96	25 00	1341
1373	" " " "	Game Guano, ...	Delano, ...	6.19	7.12	1.76	2.60	2.97	2.22	27 78	25 00	1373
1481	" " " "	Ammoniated Bone Phosphate,	Zelienople, ...	7.47	5.69	4.52	1.40	2.42	1.43	25 46	26 00	1481
1482	" " " "	Eagle Phosphate, ...	Zelienople, ...	9.92	5.75	3.94	2.18	1.23	0.75	21 64	24 00	1482
923	Baltimore Pulverizing Co., Baltimore, Md.,	Special Potato Manure, ...	Carlisle, ...	5.24	2.03	3.21	3.53	3.61	1.87	22 95	25 00	923
633	Baugh & Sons' Co., Philadelphia, Pa., ...	General Crop Grower, ...	Red Lion, ...	10.79	6.15	3.37	2.40	1.62	1.31	23 78	18 00	633
660	" " " "	Double Eagle Phosphate, ...	Red Lion, ...	8.82	5.29	4.63	3.76	0.87	2.29	27 43	23 50	660
662	" " " "	Amm'd Bone & Potash Comp'd,	Red Lion, ...	11.60	5.86	3.15	3.28	2.24	1.90	26 31	23 50	662
681	" " " "	Wheat Fertilizer, ...	Delta, ...	12.61	6.07	3.35	2.88	2.28	1.97	26 84	23 00	681
1290	" " " "	$25.00 Phosphate, ...	Rosedale, ...	10.54	6.02	3.86	3.20	0.96	2.20	26 97	24 00	1290

1048	A. H. Bierly & Son, Ladiesburg, Md., ...	Ammoniated Bone Phosphate,	Gettysburg, ...	8.57	6.05	3.36	2.02	1.00	0.56	20 33	18 00	1048
973	D. Blocher & Co., Baltimore, Md., ...	Diss. Raw Bone and Potash,	Mifflinburg, ...	10.68	8.74	2.40	0.84	2.69	2.03	29 05	23 00	973
965	Bowker Fertilizer Co., Boston, Mass., ...	Sure Crop Phosphate, ...	White Deer, ...	7.33	4.63	5.36	4.33	1.24	1.15	24 25	23 00	965
1444	" " " "	Bone and Potash, ...	Chalfont, ...	4.76	1.82	3.21	7.26	2.39	1.75	22 64	30 00	1444
1445	" " " "	Wheat Grower, ...	Chalfont, ...	5.71	5.40	6.46	3.16	1.18	0.32	15 61	23 00	1445
1093	D. M. Boyd, Jr., Danville, Pa., ...	Farmers' Champion, ...	Washingtonville, ..	7.98	4.63	4.17	6.08	3.35	0.89	25 10	23 00	1093
1038	A. R. Brodbeck, Hanover, Pa., ...	Jay Eye See Standard Amm'd,	Dillsburg, ...	9.79	6.99	4.64	2.30	1.88	0.72	24 73	25 00	1038
746	S. B. Brodbeck, Brodbeck's, Pa., ...	Reliable Phosphate, ...	York, ...	10.75	7.31	2.20	1.43	2.32	0.83	22 71	17 00	746
747	" " "	Standard Ammoniated Phos.,	York, ...	10.68	8.11	2.35	1.94	2.32	1.58	26 71	21 00	747
594	Bradley Fertilizer Co., Boston, Mass, ...	Manure for Vege. & Potatoes,	Franklin, ...	11.19	4.39	4.41	2.35	5.95	3.52	34 81	40 00	594
595	" " " "	Dissolved Bone with Potash,	Franklin, ...	12.90	4.98	3.83	2.56	3.07	1.03	22 53	30 00	595
596	" " " "	Sea Fowl Guano, ...	Franklin, ...	10.15	5.56	3.10	2.62	1.69	2.11	25 62	35 00	596
818	" " " "	Niagara Phosphate, ...	Johnstown, ...	10.83	5.23	3.09	2.31	2.21	1.09	22 23	23 00	818
820	" " " "	Ex. Fine Gr. Bone with Potash,	Johnstown, ...	4.37	1.58	4.01	10.34	1.96	3.02	25 11	27 00	820
1189	" " " "	Bean and Potato, ...	Wick, ...	13.85	4.13	4.27	1.96	4.02	1.35	24 78	30 00	1189
1439	The Bradley Fert. Co. of Phila., Phila.,Pa.,	Standard Bone Phosphate, ...	North Wales, ...	7.81	1.89	9.47	1.52	3.41	1.60	27 00	28 00	1439
1440	" " " "	Popular Fertilizer, ...	North Wales, ...	9.47	0.24	9.46	1.15	1.91	0.81	21 37	25 00	1440
811	Cambria Fertilizer Co., Johnstown, Pa., ..	Standard Phosphate, ...	Carrolltown, ...	6.95	3.90	4.02	4.94	4.69	1.52	26 84	25 00	811
1331	" " " " ..	Lion Brand Phosphate, ...	Stoyestown, ...	4.44	5.23	4.03	3.33	0.50	2.87	27 90	30 00	1331
1332	" " " " ..	Standard Phosphate, ...	Stoyestown, ...	4.78	3.29	4.00	5.69	3.74	2.35	28 24	26 00	1332
749	Chandler, Russell & Chandler, Newark, N.J.,	Champion Manure, ...	York, ...	9.69	1.74	6.79	1.49	2.73	0.85	21 40	21 00	749
750	" " " "	Harvest Queen Phosphate, ...	York, ...	9.02	5.79	6.08	1.58	2.97	1.29	27 63	23 00	750
789	Chemical Co. of Canton, Baltimore, Md.,	Harrow Brand, ...	Hanover, ...	9.00	4.73	4.13	2.97	1.49	0.57	14 85	17 00	789
900	" " " "	Red Clover Brand, ...	Gardner's Station,	5.18	4.41	3.08	1.47	1.41	0.77	18 66	18 00	900

COMPLETE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
925	Chemical Co. of Canton, Baltimore, Md.,	Baker's Standard High Grade,	Mechanicsburg, ...	8.42	7.31	1.29	2.67	2.82	2.09	26 95	25 00	925
926	" " " "	Resurgam Guano, ...	Mechanicsburg, ...	8.12	5.50	4.07	2.17	2.33	1.39	24 86	23 00	926
1506	" " " "	Baker's Sp'l C. & G. Mixture,..	Ambler, ...	8.90	4.24	4.68	2.58	2.50	0.95	22.77	25.00	1506
1455	R. L. Christie & Co., Baltimore, Md., ...	Special for Wheat and Grass,	Kirkwood, ...	10.00	6.52	2.48	3.72	1.77	1.74	25 53	19 50	1455
905	Clark's Cove Fertilizer Co., New York, ...	Defiance Complete Manure, ..	Graythorn, ...	11.71	3.84	4.45	2.96	2.10	1.34	23 05	23 00	905
906	" " " "	King Philip Alkaline Guano, ..	Graythorn, ...	15.62	3.28	2.51	2.21	3.09	1.55	21 37	25 00	906
1319	E. A. Clendennin & Bro., Colora, Md.,.......	F.F.V.,Farmers' Fav.Vegeta'r,	Nottingham, ...	9.09	6.74	3.64	2.16	1.06	0.68	22 22	18 00	1319
1372	" " " "	Q. & L. Ammoniated Phosphate,	Sarver's Station, ..	4.75	11.60	3.37	1.07	0.50	0.70	27 19	24 00	1372
1489	Cleveland Dryer Co., Cleveland, O., ...	Potato & Vegetable Fertilizer,	Zelienople, ...	8.89	5.97	2.09	5.10	3.54	2.88	30 81	34 00	1489
716	E. Frank Coe Company, New York, ...	Ammoniated Bone Super-Phos.,	Biglerville, ...	8.73	8.13	2.77	2.72	1.69	1.68	27 51	30 00	716
1066	" " "	Grass and Grain Fertilizer, ...	Biglerville, ...	7.95	7.99	3.53	2.77	1.85	1.18	26 79	25 00	1066
1144	Henry Cope & Co., Lincoln University, Pa.,	Pure Bone Phosphate, ...	West Grove, ...	4.50	2.96	7.37	3.44	2.29	1.97	27 81	25 00	1144
1275	" " " "	Pennsylvania Wheat Grower,	West Grove, ...	7.20	3.07	4.93	2.16	4.42	1.17	24 02	25 00	1275
1299	Josiah Cope & Co., Lincoln University, Pa.,	Try Me Bone Phosphate, ...	Oxford, ...	7.37	7.95	3.34	2.59	4.18	1.34	30 44	24 00	1299
1300	" " " "	Pure Bone Phosphate, ...	Oxford, ...	9.12	4.20	4.51	3.96	3.75	2.18	28 69	26 00	1300
602	Crocker Fert. & Chem. Co., Buffalo, N. Y.,	Potato, Hop and Tobacco Phos.,	Union City, ...	7.51	8.56	3.18	1.07	3.72	2.31	31 76	29 00	602
603	" " " "	Amm. Wheat & Corn Phos.,	Union City, ...	7.33	8.14	3.07	1.20	2.01	2.27	29 12	28 00	603

927	" " " "	Queen of the Harvest, ...	Mechanicsburg, ...	6.44	6.55	2.90	0.68	2.11	1.17	23 00	23 00	927
928	" " " "	Superlative Ammoniated Bone,	Mechanicsburg, ...	7.15	8.48	2.59	0.73	2.68	2.09	29 05	25 00	928
1223	" " " "	New Rival Amm. Phosphate,	Millville, ...	8.76	6.29	3.81	1.78	1.85	1.16	24 01	26 00	1223
1438	" " " "	Buffalo Fertilizer, ...	Chalfont, ...	8.29	8.43	2.76	1.42	1.92	2.13	28 81	28 00	1438
918	Cumberland County Fert. Co., Carlisle, Pa..	Patrons' Delight, Grade C., ..	Greason, ...	9.20	3.55	3.11	2.13	4.10	1.90	24 66	25 00	918
919	" " " "	Prolific Brand, ...	Greason, ...	6.88	1.63	7.62	1.99	1.31	0.59	20 08	18 00	919
920	" " " "	Alliance Favorite, No. 1., ...	Greason, ...	10.11	3.93	4.78	2.36	2.17	1.08	22 41	20 00	920
1190	Cumb'land Bone—Phos. Co., Boston, Mass.,	Cumberland Guano, ...	Wick, ...	11.68	5.19	3.63	2.14	2.23	1.22	23 08	22 00	1190
1213	" " " "	Hawkeye Fertilizer, ...	Middle Lancaster,	13.22	4.70	3.70	2.09	1.28	1.10	21 15	26 00	1213
1215	" " " "	Super-Phosphate, ...	Middle Lancaster,	8.83	3.95	5.17	2.80	2.37	2.13	26 91	32 00	1215
1216	" " " "	Guano, ...	Middle Lancaster,	10.44	5.04	3.62	2.40	2.09	0.96	22 00	28 00	1216
778	Louis F. Detrick, Baltimore, Md., ...	Sockless & Shoeless Phosphate,	Turnpike Station...	11.23	7.09	2.62	2.51	1.37	1.24	23 76	19 00	778
762	Detrick Fert. & Chem. Co., Baltimore, Md.,	Ammoniated Bone Phosphate,	Glen Rock, ...	11.04	7.90	1.97	2.72	1.23	1.37	24.42	20 00	762
839	" " " "	Imperial Compound, ...	Tyrone, ...	10.84	7.91	2.50	2.35	1.16	0.88	23 23	19 00	839
1080	" " " "	Special Mixture, ...	Middleburg, ...	9.20	6.84	2.67	3.78	1.22	1.03	23 28	18 00	1080
1088	" " " "	Royal Crop Grower, ...	Strawberry Ridge,	6.81	7.35	2.64	3.44	2.03	1.84	27 38	20 00	1088
1419	Jas. G. Downward & Co., Coatesville, Pa.,	High Grade Raw Bone Phos.,	Gwynedd, ...	9.41	6.90	1.70	0.91	4.94	2.54	29 90	35 00	1419
1467	" " " "	Bone, Rock and Potash, ...	Norwood, ...	8.65	4.49	3.77	2.27	4.45	0.66	22 98	19 00	1467
719	Eureka Fertilizer Co., Perryville, Md., ...	Grain and Grass Mixture, ...	Fairfield, ...	10.18	7.53	3.73	2.81	1.78	0.93	25 29	22 00	719
769	" " " "	Standard Bone Phosphate, ...	Stewartstown, ...	10.67	7.20	3.54	2.36	2.23	1.01	25 09	22 00	769
835	" " " "	Imperial Bone Phosphate, ...	Bradley Junction, .	9.25	7.60	3.11	3.61	1.46	0.89	24 48	21 00	835
837	" " " "	Farmers' Favorite Bone Phos.,	Bradley Junction, .	9.22	7.47	3.11	3.33	1.13	1.14	23 60	24 00	837
1087	" " " "	Farmers' Favorite Bone Phos.,	Turbotville, ...	9.19	7.02	3.51	3.00	1.98	1.22	25 54	23 00	1087
754	Eurich & Brooks, York, Pa., ...	Farmers' Favorite Phosphate,	York, ...	4.27	5.75	4.94	1.65	1.15	0.56	15 21	20 00	754
1056	W. S. Farmer & Co., Baltimore, Md., ...	Clyde Brand, ...	Littlestown, ...	9.47	7.64	2.42	1.02	2.53	0.88	23 71	20 00	1056

COMPLETE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
699	Farmers' Fertilizer Co., Westminster, Md.,	No. 1. Bone Phosphate,	New Oxford,	12.01	7.04	2.84	1.20	2.70	1.96	27 18	22 00	699
1042	" " " "	No. 3 Bone Phosphate,	Dillsburg,	11.15	7.94	2.40	1.14	2.59	1.38	25 84	20 00	1042
1682	Garbage Plant at Lancaster, Pa.,	Garbage Ashes,	Lancaster,	0.23	0.15	0.37	1.64	0.35	0.06	1 64	.....	1682
1509	Joseph R. Gawthrop, Kennett Square, Pa.,	Complete Am. Bone Phosphate,	Concord,	2.86	5.72	2.44	4.66	2.01	1.14	23 36	23 00	1509
1510	" " " "	Champion Bone Fertilizer,	Concord,	2.83	2.81	3.26	9.03	2.00	2.05	25 56	25 00	1510
580	Charles V. Geiger, Geigers' Mills, Pa.,	Pennsylvania Crop Grower,	Hummelstown,	7.97	6.05	3.32	1.31	1.45	0.90	21 63	20 00	580
1496	" " " "	Try Me Bone and Potash,	Gap,	8.88	6.55	2.74	1.30	6.04	1.79	29 56	25 00	1496
644	Griffith & Boyd, Baltimore, Md.,	Queen Phosphate,	Lewisburg,	11.30	6.32	2.64	2.21	2.77	1.14	23 79	25 00	644
941	" " "	Peerless Fertilizer,	Paxinos,	9.80	4.63	3.18	1.95	2.34	0.33	14 07	16 00	941
968	" " "	Ammoniated Bone Phosphate,	New Columbia,	7.04	8.04	2.46	2.35	2.47	1.68	27.66	24 00	968
969	" " "	Cereal Bone Plant Food,	New Columbia,	10.71	5.00	3.28	2.21	2.61	0.73	21 34	20 00	969
1065	" " "	Valley Fertilizer,	Littlestown,	7.24	5.21	3.38	2.43	3.50	0.54	16 57	15 00	1065
578	Great Eastern Fertilizer Co., New York,	English Wheat Grower,	Shartlesville,	6.11	0.64	10.07	1.42	2.11	0.94	23 52	23 50	578
586	" " " "	General Wheat Special,	Hummelstown,	3.41	0.44	10.03	1.50	2.03	1.73	25 82	23 00	586
587	" " " "	English Wheat Grower,	Hummelstown,	7.72	0.70	10.13	1.45	1.99	0.96	23 55	19 00	587
588	" " " "	Great Eastern General,	Hummelstown,	8.48	0.45	9.57	1.15	3.87	1.22	25 38	22 50	588
733	Hanover Bone Fert. Co., Hanover, Pa.,	Farmers' Crop Winner,	New Oxford,	6.09	3.98	5.01	1.26	1.85	0.57	14 64	16 00	733

734	" " " "	Blood and Bone Compound, ...	New Oxford, ...	7.01	5.15	3.56	1.80	2.60	1.05	22 66	19 50	734
888	" " " "	Daron's Harvest King, ...	Hanover, ...	5.36	6.14	3.13	2.16	5.09	1.71	28 56	23 00	888
1337	S. M. Hess & Bro., Philadelphia, Pa., ...	Keystone Bone Phosphate, ...	Bedford, ...	8.93	7.70	2.66	1.26	2.24	0.88	23 80	23 00	1337
1456	John W. Hickman, Russellville, Pa., ...	New Method Insecticide Fert.,	Kirkwood, ...	9.09	7.92	2.97	1.47	3.37	0.95	25 95	21 00	1456
1415	Frank Houston, Ambler, Pa., ...	Wheat Grower, ...	Ambler, ...	14.94	8.90	2.00	0.31	2.60	1.73	27 38	26 00	1415
1416	" " "	General Crop Fertilizer, ...	Ambler, ...	7.39	8.61	4.59	1.48	1.23	0.99	26 71	23 00	1416
779	Hubbard & Co., Baltimore, Md., ...	Stan'd Bone Super-Phosphate,	Turnpike Station,..	10.39	6.63	3.71	1.54	2.37	1.30	25 28	20 00	779
1229	" " "	Wheat Growers' Jewel, ...	Millville, ...	6.98	8.50	3.76	1.85	1.44	1.37	27 12	25 00	1229
689	M. P. Hubbard & Co., Baltimore, Md., ...	Farmers' Old Economy, ...	Stewartstown, ...	7.70	5.72	2.29	1.81	1.42	0.85	19 92	16 00	689
793	" " " "	Ammoni'd Bone and Potash,	Hanover, ...	7.78	6.88	2.51	1.02	1.82	0.69	21 28	19 00	793
1247	" " " "	Harvest King, ...	Kingwood, ...	7.50	6.83	2.50	1.53	1.40	1.43	23 55	20 50	1247
1173	Jarecki Chemical Co., Sandusky, Ohio, ...	Lake Erie Fish Guano, ...	Slippery Rock, ...	10.93	7.73	4.10	1.33	2.66	1.47	27 92	25 00	1173
1180	" " " "	Fish & Potash Grain Special,	Slippery Rock, ...	12.46	6.89	3.48	1.12	4.74	1.73	29 25	25 00	1180
1238	" " " "	O. K. Fertilizer, ...	Atchison, ...	2.98	3.55	4.37	0.86	0.56	0.65	17 62	15 00	1238
1240	" " " "	Lake Erie Fish Guano, ...	Atchison, ...	6.19	4.53	5.58	1.49	2.85	1.96	27 51	23 00	1240
783	J. A. Klinefelter, Glenville, Pa., ...	Special for Corn, Oats, etc., ..	Glenville, ...	5.83	3.96	3.69	1.11	1.04	0.77	18 25	18 00	783
1009	Lackawanna Fert. & Chem.Co., Moosic, Pa.,	Moosic Phosphate, ...	Black Lick, ...	4.38	6.34	2.42	1.05	1.84	1.46	23 22	20 00	1009
1448	Lancaster Water Works, Lancaster, Pa., ..	Boiler Deposit, ...	Lancaster, ...	3.63	....	0.20	0.49	0.12	0.29	1 36	.....	1448
686	Lazaretto Guano Co., Baltimore, Md., ...	Retriever Animal Bone Phos.,	Delta, ...	8.77	7.80	4.16	3.14	4.21	2.01	32 44	21 00	686
597	Lister's Agri. Chem. Works, Newark, N. J.,	Success Fertilizer, ...	Franklin, ...	8.72	7.94	3.37	1.85	3.05	1.35	26 64	28 00	597
673	" " " "	Standard Phosphate, ...	Muddy Creek Forks,	10.74	9.66	2.95	1.48	2.08	2.18	31 06	26 00	673
1022	" " " "	Special Fertilizer for Wheat,	Saltsburg, ...	7.58	6.08	3.61	2.48	1.98	1.55	25 35	23 00	1022
1084	" " " "	U. S. Super-Phosphate, ...	Turbotville, ...	4.55	5.32	3.15	1.44	1.98	1.37	22 81	23 00	1084
1105	" " " "	Ammoniated Dissolved Phos.,	Bloomsburg, ...	9.15	6.84	2.53	2.24	1.80	1.68	25.18	28 00	1105
1106	" " " "	Special Crop Producer, ...	Bloomsburg, ...	4.66	3.84	3.66	2.99	1.15	0.91	19 58	20 00	1106

COMPLETE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1116	Lister's Agri. Chem. Works, Newark, N. J.,	Harvest Queen Phosphate, ...	Linwood, ...	8.94	7.02	4.19	1.78	2.41	1.45	27 01	27 00	1116
1262	" " " "	Special Potato Fertilizer, ...	Mercersburg, ...	7.25	6.39	4.08	1.88	3.20	1.70	28 03	23 00	1262
1046	John A. Livers, Gettysburg, Pa., ...	Gold Dust Fertilizer, ...	Gettysburg, ...	5.12	1.73	3.94	2.23	1.48	0.96	17 32	20 00	1046
1032	Mapes' Formula & Peruv'n Guano Co., N.Y.,	Cereal Brand, ...	Shiremanstown, ...	7.32	4.68	2.63	2.30	3.52	2.22	26 00	28 00	1032
1033	" " " "	Complete Manure, A. Brand, ..	Shiremanstown, ...	7.26	4.92	4.23	3.66	3.67	2.80	31 08	35 00	1033
691	Noah Markle, Seitzland, Pa., ...	Ammoniated Bone Phosphate,	Seitzland, ...	10.19	3.58	3.75	2.31	2.63	1.33	22 16	20 00	691
626	Maryland Fertilizing Co., Baltimore, Md.,	Ammoniated Bone, ...	Huntingdon, ...	8.89	6.44	2.69	3.54	2.01	1.94	26 55	28 00	626
628	" " " "	Ammoniated O. K. Fertilizer,	Huntingdon, ...	9.74	6.25	2.40	1.72	2.14	1.08	22 38	21 00	628
615	McCalmont & Co., Bellefonte, Pa., ...	Champion Brand, ...	Loverville, ...	5.35	4.65	7.03	1.59	3.44	1.68	29 49	25 00	615
714	F. Mehring, Bruceville, Md., ...	Twenty-six Dollars Phosphate,	Biglerville, ...	10.34	9.11	3.89	4.66	1.27	1.22	28 71	23 00	714
565	Michigan Carbon Works, Detroit, Mich., ..	Homestead, A Bone Black Fer.,	Glade, ...	13.45	6.60	1.83	1.28	2.41	2.58	27 26	27 00	565
607	" " " " ..	Homestead, A Bone Black Fer.,	Union City, ...	8.70	9.67	1.24	1.17	2.33	2.49	30 20	27 00	607
1177	" " " " ..	Homestead, A Bone Black Fer.,	Slippery Rock, ...	7.39	8.68	2.40	1.07	2.84	2.34	30 58	27 00	1177
1220	" " " " ..	Homestead Potato Grower, ...	Harmony, ...	12.56	7.92	1.42	1.76	5.21	1.96	29 59	33 00	1220
1383	" " " " ..	Jarves' Drill Phosphate, ...	Slippery Rock, ...	4.29	6.51	2.17	1.09	0.78	1.42	21 66	23 00	1383
1494	" " " " ..	Homestead, A Bone Black Fer.,	Mt. Chestnut, ...	9.40	8.90	1.46	1.05	1.45	2.48	28 36	25 00	1494
679	Miller Fertilizer Co., Baltimore, Md., ...	Hustler Phosphate, ...	Muddy Creek Forks,	10.03	7.06	2.50	1.96	2.73	1.03	24 15	20 00	679

896	" " " "	W. G. Phosphate,	Aspers' Station,	6.82	5.79	2.53	1.54	1.73	0.50	14 22	18 00	896
1037	" " " "	St'd Super-Phosphate of Lime,	Dillsburg,	7.31	7.84	3.57	1.02	2.94	1.89	29 14	26 00	1037
1121	" " " "	Harvest Queen Phosphate,	Ogden,	7.19	9.10	2.15	1.38	2.44	1.22	26 35	26 00	1121
591	Milsom Rend'g & Fert. Co., Buffalo, N. Y.,	Buffalo Fertilizer,	Sandy Lake,	9.68	6.05	2.19	2.33	1.63	1.67	23 47	28 00	599
600	" " " "	Wheat, Oats and Barley Sp'l,	Sandy Lake,	7.52	7.74	2.16	2.48	2.11	1.20	24 85	26 00	600
601	" " " "	Potato, Hop & Tobacco Phos.,	Sandy Lake,	7.23	5.58	2.00	1.75	3.26	2.01	25 27	20 00	601
1029	" " " "	Buckwheat Special Fertilizer,	Indiana,	6.59	4.51	2.68	2.80	0.95	0.92	18 98	20 00	1029
1281	Monumental Chemical Co., Baltimore, Md.,	William Penn Crop Grower,	Toughkenamon,	6.85	3.87	3.56	1.76	1.09	0.94	18 97	18 00	1281
625	T. S. Moorehead, East Waterford, Pa.,	Ammoniated Tuscarora Phos.,	Petersburg,	6.74	1.54	2.96	5.76	1.31	1.10	17 85	20 00	625
1511	" " " "	Ammoniated Tuscarora Phos.,	Mexico,	8.01	1.65	2.82	5.67	1.22	1.08	17 71	16 50	1511
1067	Niagara Fertilizer Works, Buffalo, N. Y.,	No. 1 Ammoniated Bone Fert.,	Hanover,	7.78	7.62	3.58	2.02	1.41	1.70	26 94	22 00	1067
1198	" " " "	Wheat and Corn Producer,	Murrinsville,	8.90	5.80	3.60	1.62	3.78	1.57	26 46	27 00	1198
666	North Western Fertilizer Co., Chicago, Ill.,	Bone and Potash,	Red Lion,	6.28	8.13	3.90	2.85	1.53	0.89	26 10	20 00	666
812	" " " "	Garden City Super-Phosphate,	Johnstown,	6.92	6.19	2.63	2.77	1.09	3.45	30 00	27 00	812
813	" " " "	Prairie Phosphate,	Johnstown,	6.06	4.89	2.93	5.69	0.67	2.26	25 48	25 00	813
814	" " " "	Ammoniated Dissolved Bone,	Johnstown,	6.55	6.24	2.72	2.33	1.03	3.72	30 66	27 00	814
827	" " " "	Twenty-six Dollars Phosphate,	Willmore,	5.25	5.18	3.22	3.63	0.88	3.62	30 03	25 00	827
1328	" " " "	H'shoe Brand Nat'l Bone Dust,	Nottingham,	6.08	5.96	4.01	3.30	1.12	3.75	29 20	25 00	1328
1150	Oakfield Fertilizer Co., Buffalo, N. Y.,	High Farming Fertilizer,	Shepherdstown,	14.37	5.52	2.43	1.61	2.59	2.04	25 06	30 00	1150
1151	" " " "	Golden Sheaf Fertilizer,	Shepherdstown,	11.13	5.09	3.70	0.98	2.30	1.44	23 38	24 00	1151
1152	" " " "	Standard Fertilizer,	Shepherdstown,	7.85	7.44	3.25	1.76	2.08	2.58	29 98	33 00	1152
1381	" " " "	Great Value Fertilizer,	Slippery Rock,	12.18	3.93	3.86	1.09	1.20	1.19	20 10	21 00	1381
1468	" " " "	Domestic Fertilizer,	Sugar Grove,	11.87	3.82	3.65	1.67	1.43	1.94	22.78	24 00	1468
1158	W. C. Owens, Philipsburg, Pa.,	Ammoniated Phosphate,	Philipsburg,	8.29	5.47	4.06	2.63	2.42	1.02	23 68	25 00	1158
950	Pacific Guano Co., New York,	A No. 1 Phosphate,	Paxinos,	13.65	4.25	4.35	2.72	2.11	1.28	23 17	21 00	950

COMPLETE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
951	Pacific Guano Co., New York, ...	Nobsque Guano, ...	Paxinos, ...	14.14	4.27	4.77	2.53	2.11	1.32	23 58	23 00	951
554	Patapsco Guano Co., Baltimore, Md., ...	Grain and Grass Producer, ...	Somerset, ...	16.55	7.28	2.59	1.55	2.51	0.85	23 40	23 00	554
1099	" " " "	Coon Brand Guano, ...	Pottsgrove, ...	11.15	6.83	3.17	1.25	3.06	0.92	24 15	18 00	1099
1233	" " " "	Special Wheat Compound, ...	Greenwood, ...	7.76	8.54	2.85	2.56	2.70	1.90	29 64	24 00	1233
1034	Penn. Am'nia & Fert. Co., Harrisburg, Pa.,	Capital Bone Super-Phosphate,	Bowmansdale, ...	5.79	8.56	2.57	1.75	2.32	2.69	31 21	30 00	1034
1035	" " " "	Dauphin Brand, ...	Shiremanstown, ...	7.64	7.64	3.37	1.94	2.62	1.47	27 14	24 00	1035
582	Moro Phillips Chem. Co., Philadelphia, Pa.,	Farmers' Phosphate, ...	Strausstown, ...	9.60	6.23	2.68	1.65	1.78	0.76	21 09	18 00	582
583	" " " "	C. & G. Complete Fertilizer, ..	Berks, ...	8.96	5.35	2.32	1.98	3.12	1.12	22 23	20 00	583
1103	" " " "	C. & G. Complete Fertilizer, ..	Pottsgrove, ...	10.95	5.20	1.92	1.70	1.52	1.06	19 64	19 50	1103
622	Piedmont—Mt. Airy Guano Co., Balti., Md.,	Piedm't Pure Raw Bone Phos.,	Petersburg, ...	6.63	3.44	5.36	2.33	1.19	0.98	21 16	22 00	622
623	" " " "	Am. Bone, Grain & Grass Pro.,	Petersburg, ...	11.18	7.44	3.55	1.16	1.96	0.77	23 68	22 00	623
1376	Pittsburg Provision Co., Pittsburg, Pa., ..	Keystone Fertilizer, ...	Butler, ...	3.07	3.46	4.58	3.15	0.90	1.70	22 78	26 00	1376
653	R. H. Pollock, Baltimore, Md., ...	Sp'l Potato & Tobacco Fert.,	East Berlin, ...	8.48	7.76	1.82	2.95	4.60	1.69	28 95	24 00	653
657	" " "	Superior Corn & Tomato Fert.,	Red Lion, ...	10.58	7.58	2.93	1.66	2.56	1.43	26 34	22 00	657
659	" " "	Ammoniated Bone Phosphate,	Red Lion, ...	13.11	8.11	2.55	1.90	2.18	1.72	27 15	24 00	659
1318	" " "	Special Wheat Grower, ...	Nottingham, ...	11.33	7.65	2.34	2.79	2.22	1.09	24 74	22 00	1318
871	Powell Fert. & Chem. Co., Baltimore, Md.,	Red Bag Brand, ...	Mt. Pleasant, ...	4.57	2.89	5.66	4.59	2.69	1.01	23 49	18 00	871

1297	Pugh & Lyon, Oxford, Pa.,	Bone Phosphate,	Oxford,	6.59	2.74	6.77	1.48	5.06	2.61	31 05	25 00	1297
865	Quinnipiac Co., New York,	Climax Phosphate,	Newry,	11.39	2.93	5.99	3.79	2.16	1.44	24 45	20 00	865
909	" " "	Ammoniated Dissolved Bone,	Graythorn,	7.55	5.73	4.39	3.66	2.10	2.09	28 48	28 00	909
937	" " "	Mohawk Fertilizer,	Red Top,	11.60	2.13	5.14	3.17	1.06	1.05	19 60	20 50	937
889	Ramsburg Fertilizer Co., Frederick, Md.,	Excelsior Plant Food,	New Oxford,	8.12	8.79	3.28	4.87	0.79	1.91	29 55	24 00	889
1060	" " " "	Alkaline Phospho Potassium,	Littlestown,	11.16	5.83	5.92	2.47	1.74	0.79	24 97	18 00	1060
801	Rasin Fertilizer Co., Baltimore, Md.,	Ammoniated Super-Phosphate,	Carrolltown,	12.01	7.44	4.47	2.02	1.17	1.04	25 38	20 50	801
802	" " " "	Empire Guano.	Carrolltown,	11.87	6.38	2.79	3.03	1.70	2.17	26 71	25 00	802
1079	" " " "	Ammoniated Alkaline Phos.,	Middleburg,	11.18	5.32	4.41	2.86	1.49	1.77	25 62	19 00	1079
664	John S. Reese & Co., Baltimore, Md.,	May Flower Brand,	Red Lion,	8.80	0.81	9.60	1.28	2.03	1.82	25 87	23 00	664
1409	" " " "	Amm. Bone Phosphate Mixt're,	Windsor Castle,	10.34	7.96	2.85	2.21	1.98	1.41	26 24	22 00	1409
1449	" " " "	Amm. Bone Phosphate Mixt're,	Harrisburg,	11.41	2.10	10.13	1.50	3.21	0.93	25 64	22 00	1449
1473	Riverside Acid Works, Warren, Pa.,	Old Gold Brand,	Warren,	8.51	9.30	1.67	0.62	2.06	3.13	31 94	36 00	1473
1474	" " " "	Rich Acre Brand,	Warren,	9.85	7.28	1.82	0.57	1.57	1.94	24 72	30 00	1474
1475	" " " "	Harvest Moon Brand,	Warren,	5.91	5.77	3.29	0.36	1.23	1.60	22 95	25 00	1475
1325	Scott Fertilizer Co., Elkton, Md.,	Elk Head Super-Phosphate,	Nottingham,	8.21	7.84	3.66	1.30	1.05	0.91	23 94	21 00	1325
1408	" " " "	Sure Growth Super-Phosphate,	Windsor Castle,	10.14	6.60	3.25	2.68	2.74	1.99	28 00	22 00	1408
825	Sharpless & Carpenter, Philadelphia, Pa.,	No. 1 Bone Phosphate,	Johnstown,	9.95	7.25	2.36	1.97	1.96	1.69	25 58	26 00	825
1500	" " " "	Grain and Grass Fertilizer,	Ambler,	5.40	7.32	2.73	1.91	1.20	0.60	21 63	20 00	1500
775	G. W. Sharretts & Co., Baltimore, Md.,	Standard Guano,	New Freedom,	11.41	5.50	2.43	2.34	1.44	1.59	22 68	22 00	775
1096	" " " "	Fish, Rock and Potash,	Mooresburg,	6.90	2.21	3.90	0.88	0.67	0.32	10 88	17 00	1096
1431	M. L. Shoemaker & Co., Philadelphia, Pa.,	Swift-Sure, for General Use,	Lansdale,	12.27	8.56	2.53	2.95	4.47	2.60	33 72	31 00	1431
1436	" " " "	Echo Super-Phosphate,	Doylestown,	4.14	3.75	5.53	4.77	2.13	1.29	24 99	21 00	1436
1059	Slingluff & Co., Baltimore, Md.,	Universal Guano,	Littlestown,	5.40	7.84	4.08	1.56	1.67	0.85	25 08	20 00	1059
1147	Standard Fertilizer Co., Boston, Mass.,	Standard Guano,	Chambersburg,	13.00	3.48	4.83	3.08	2.10	1.26	22 77	21 00	1147

COMPLETE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1175	Standard Fertilizer Co., Boston, Mass., ...	Standard A. Brand, ...	Slippery Rock, ...	8.35	4.77	4.31	2.28	1.16	1.48	23 23	24 00	1175
670	Susquehanna Fertilizer Co., Baltimore, Md.,	XXV Phosphate, ...	Windsor Station, ..	9.63	6.98	2.92	1.67	1.41	1.12	23 12	20 50	670
709	" " " "	Susquehanna Crop Grower, ...	Biglerville, ...	7.96	2.19	6.52	4.21	1.08	0.89	21 33	18 00	709
974	" " " "	Susquehanna Bone Phosphate,	Mifflinburg, ...	10.02	7.45	3.67	2.69	2.31	2.07	29 29	27 00	974
1127	" " " "	Pure Bone Phosphate, ...	Kelton, ...	4.90	6.58	5.73	5.46	1.80	1.57	29 72	25 00	1127
1128	" " " "	Ammoniated Bone Phosphate,	Kelton, ...	9.51	7.28	3.68	2.55	2.33	1.97	28 74	21 00	1128
591	I. P. Thomas & Son Co., Philadelphia, Pa.,.	Normal Bone Phosphate, ...	Shartlesville, ...	8.57	8.59	3.09	3.18	2.03	1.42	27 43	25 00	591
635	" " " "	Potato Manure, ...	Orbisonia, ...	7.27	6.76	2.19	1.93	6.96	3.25	35 38	34 00	635
1051	" " " "	Improved Super-Phosphate, ..	Littlestown, ...	10.98	7.16	2.81	2.02	1.79	0.95	23 32	20 00	1051
1410	" " " "	Normal Bone Phosphate, ...	Windsor Castle, ...	11.07	1.65	10.64	0.95	3.82	0.94	27 12	24 00	1410
1266	D. A. Thomas, Hagerstown, Md., ...	Bone Mixture, ...	Greencastle, ...	10.03	8.61	1.85	1.88	2.21	1.78	27 31	30 00	1266
1278	Tygert—Allen Fert. Co., Philadelphia, Pa.,	Star Bone Phosphate, ...	Toughkenamon, ...	8.39	8.29	1.89	1.42	2.66	1.99	27 90	25 00	1278
1342	" " " "	Ammoniated Bone Phosphate,	Everett, ...	6.10	5.40	2.54	1.56	1.53	1.15	20 88	24 00	1342
1429	" " " "	Azotized Dissolved Bone, ...	Gwynedd, ...	8.68	5.26	2.42	1.56	2.11	1.05	20 82	25 00	1429
786	Virginia—Carolina Chem.Co.,Richmond,Va.,	Special Compound for Wheat,	Hanover, ...	8.77	6.69	2.52	1.45	1.08	0.97	21 32	18 00	786
722	Joshua Walker, Baltimore, Md., ...	Old Pittsburg Ammo'ted Bone,	McKnightstown, ..	10.94	5.38	3.74	3.04	1.67	2.15	26 44	20 75	722
1430	F. K. Walt Co., Pennsburg, Pa., ...	XX Flesh Fertilizer, ...	Lansdale, ...	8.22	5.63	2.78	1.68	2.49	1.19	22 75	25 00	1430

1133	M. E. Wheeler & Co., Rutland, Vt., ...	Royal Wheat Grower, ...	New London, ...	8.68	7.85	1.23	1.69	2.35	0.99	22 93	20 00	1133
562	Williams & Clark Fertilizer Co., New York,	Universal Am. Dissolved Bone,	Somerset, ...	14 58	5.49	4.15	3.41	2.17	2.01	27 45	28 00	562
911	" " " "	Peach Tree Fertilizer, ...	Leesburg, ...	3.87	1.06	2.79	12.14	4.34	1.83	27 39	33 00	911
868	Robert A. Wooldridge Co., Baltimore, Md.,	Little Giant, ...	Stahlstown, ...	9.93	7.76	2.72	1.34	2.32	1.00	24 37	21 00	868
869	" " " "	Triumph Brand, ...	Stahlstown, ...	9.02	6.35	2.39	1.38	4.53	1.31	25 95	25 00	869
1324	" " " "	Kangaroo Komplete Komp'd,	Nottingham, ...	8.97	6.28	2.41	2.51	2.86	1.71	25 59	24 00	1324
742	Joseph Wolf, Abbottstown, Pa., ...	Spring Run Raw Bone Phos.,	Abbottstown, ...	4.94	2.26	4.34	1.85	2.57	1.05	19 77	22 00	742
744	" " "	Fifteen Dollars Phosphate, ...	Abbottstown, ...	9.77	3.94	2.51	0.87	1.62	0.41	12 13	15 00	744
698	York Chemical Works, York, Pa., ...	Am. Bone and Potash Phos.,	Abbottstown, ...	8.32	4.75	5.43	2.76	3.38	0.70	24 56	20 00	698
751	" " "	Pure Am. Raw Bone Phos.,	York, ...	7.11	5.71	4.85	3.72	1.48	1.22	25 20	24 00	751
638	The Zell Guano Co., Baltimore, Md., ...	Calvert Guano, ...	Winfield, ...	8.16	8.65	2.43	2.43	1.73	0.83	24 67	19 50	638
640	" " " "	Economizer, ...	Winfield, ...	9.78	7.10	3.76	2.92	1.40	0.93	24 39	20 00	640
641	" " " "	The Little Giant, ...	Winfield, ...	9.83	6.58	2.85	1.19	1.03	1.25	22 39	17 00	641
1242	" " " "	Bone Super-Phosphate, ...	Canonsburg, ...	9.93	8.18	3.03	0.55	2.37	1.86	27 85	26 00	1242

ALKALINE FERTILIZERS.

Containing Phosphoric Acid and Potash.

From Samples Selected from August 1, 1897, to January 1, 1898.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1012	Baltimore Guano Co., Baltimore, Md., ...	Farmers' Dissolved Bone, ...	Livermore, ...	7.56	9.62	5.01	1.28	2.12	$17 05	$12 25	1012
1483	" " " "	Farmers' Alkaline Bone, ...	Zelienople, ...	12.91	1.42	8.19	1.33	2.18	13 20	28 00	1483
1268	Baltimore Pulverizing Co., Baltimore, Md..	Concentrated Bone & Pot. Mix..	Altenwalt, ...	12.74	6.43	2.92	0.79	4.17	15 56	15 00	1268
1265	D. Blocher & Co., Gettysburg, Pa., ...	Special Mixture, ...	Greencastle, ...	7.92	6.41	4.88	1.08	2.54	15 09	16 00	1265
1359	Bowker Fertilizer Co., Boston and N. Y.,	Harvest Bone, with Potash. ..	New Castle, ...	6.01	4.02	7.00	4.79	1.03	15 35	20 00	1359
788	Chemical Co. of Canton, Baltimore, Md., ..	Soluble Alkaline Bone, ...	Hanover, ...	7.97	8.34	4.62	2.14	2.17	16 28	17 00	788
1450	R. L. Christie & Co., Baltimore, Md., ...	Soluble Bone and Potash, ...	Tayloria, ...	9.80	7.27	4.45	1.68	2.89	16 04	12 00	1450
904	Clark's Cove Fertilizer Co., New York, ...	Triumph Bone and Potash, ...	Graythorn, ...	8.37	9.49	2.03	2.35	2.40	15 88	19 00	904
1298	Josiah Cope & Co., Lincoln University, Pa.,	Soluble Bone and Potash, ...	Oxford, ...	11.41	8.29	4.14	1.49	2.48	16 10	14 00	1298
1108	J. A. Cranston Co., Wilmington, Delaware,	Horseshoe Soluble Bone & Pot.,	Bloomsburg, ...	11.42	2.75	6.54	4.19	2.17	14 16	18 00	1108
618	Louis F. Detrick, Baltimore, Md., ...	Bone & Potash, 16x4 Mixture,	Loveville, ...	13.11	5.97	4.35	4.08	2.36	15 31	18 00	618
978	" " " "	Bone and Potash Mixture, ...	Mifflinburg, ...	11 13	6.01	4.67	3.98	3.52	15 64	16 00	978
840	Detrick Fert. & Chem. Co., Baltimore, Md.,	P. & B. Special Fertilizer, ...	Tyrone, ...	9.71	8.22	2.74	1.57	3.64	16 51	17 00	840
1130	James G. Downward & Co., Coatesville, Pa.,	Soluble Bone and Potash, ...	Kelton, ...	12.00	8.57	1.80	0.56	3.65	16 10	18 00	1130

718	Eureka Fertilizer Co., Perryville, Md., ...	Alkaline Bone and Potash, ...	Fairfield, ...	8.76	6.88	4.18	2.62	2.69	15 74	15 00	718
833	" " " "	Alkaline Bone and Potash, ...	Bradley Junction, ...	11.15	6.56	4.27	3.25	2.37	15 42	16 00	833
737	Farmers' Fertilizer Co., Westminster, Md.,	P. A. & P. Phosphate, ...	New Oxford, ...	8.75	9.16	3.86	0.93	3.04	16 95	16 00	737
1457	W. S. Farmer & Co., Baltimore, Md., ...	B. & P. Fertilizer, ...	Peach Bottom, ...	9.02	8.03	4.67	2.22	1.02	14 86	12 00	1457
589	Great Eastern Fertilizer Co., New York, ..	Soluble Bone and Potash, ...	Hummelstown, ...	11.53	6.51	4.95	1.76	2.12	14 96	17 00	589
794	M. P. Hubbard & Co., Baltimore, Md., ...	Soluble Bone and Potash, ...	Hanover, ...	11.52	7.47	2.76	0.65	2.03	13 92	15 00	794
1504	Keystone Chem. Mfg. Co., Camden, N. J.,	Soluble Bone and Potash, ...	Fort Washington, ...	13.27	5.88	5.21	1.89	1.95	14 56	22 00	1504
784	Maryland Fertilizing Co., Baltimore, Md.,	Alkaline Bone, ...	Hanover, ...	11.88	8.20	4.19	1.75	2.81	16.49	20 00	784
854	" " " "	Linden Super-Phosphate, ...	Curryville, ...	9.26	9.13	3.46	2.33	1.85	15 90	17 00	854
857	" " " "	Bone Super-Phosphate, ...	Curryville, ...	8.03	9.70	2.78	1.12	1.80	15 40	15 00	857
1329	Monumental Chemical Co., Baltimore, Md.,	Soluble Bone Phos. & Potash,	Nottingham, ...	7.28	5.19	2.42	0.70	8.46	18 97	13 00	1329
1255	G. Ober & Sons' Co., Baltimore, Md., ...	Dis. Bone Phosphate & Potash,	Chambersburg, ...	10.80	9.85	3.24	0.65	2.55	16 45	13 00	1255
990	Pacific Guano Co., New York, ...	Dissolved Bone and Potash, ...	Petersburg, ...	8.50	8.52	2.77	1.66	2.19	15 19	16 00	990
851	Packers' Union Fertilizer Co., New York, ..	H. G. Wheat and Clover Fer.,	McKee, ...	6.86	9.21	3.07	0.71	2.17	15 46	17 00	851
914	Moro Philips Chem. Co., Philadelphia, Pa.,	Soluble Bone Phosphate, ...	Shippensburg, ...	5.82	10.82	4.17	1.43	2.22	17 84	12 50	914
915	" " " "	Wheat Special, ...	Shippensburg, ...	10.86	5.86	2.95	1.72	2.12	13 29	17 00	915
1070	" " " "	Alkaline Bone, ...	Shamokin Dam, ...	9.10	7.78	4.33	1.71	2.54	15 97	16 00	1070
992	Piedmont—Mt. Airy Guano Co., Balti., Md.,	Dissolved Bone Phosphate, ...	Petersburg, ...	7.76	6.89	3.99	1.53	1.28	13 71	17 00	992
728	R. H. Pollock, Baltimore, Md., ...	Alkaline Bone Phosphate, ...	Biglerville, ...	10 22	7.08	3.64	0.45	1.33	13 30	13 50	728
1317	" " "	Victor Bone Phosphate, ...	Nottingham, ...	13.10	7.48	3.05	2.77	1.22	13.93	18 00	1317
864	Quinnipiac Co., New York, ...	Dissolved Bone and Potash, ...	Newry, ...	6.82	8.94	2.67	2.44	2.46	15 98	14 00	864
1149	Standard Fertilizer Co., Boston, Mass, ...	Bone and Potash, ...	Chambersburg, ...	4.33	4.85	4.48	3.91	2.19	14 64	14 00	1149
1176	" " " "	Bone and Potash, ...	Slippery Rock, ...	10.87	5.34	4.89	1.98	2.79	14 92	26 00	1176
712	Susquehanna Fertilizer Co., Baltimore, Md..	Soluble Bone and Potash, ...	Biglerville, ...	11.56	1.43	9.14	2.33	2.16	14 10	14 00	712

ALKALINE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
590	I. P. Thomas & Son Co., Philadelphia, Pa.,	Alkaline Bone,	Shartlesville,	5.95	8.69	2.96	2.31	2.04	15 49	15 50	590
1225	Tygert—Allen Fert. Co., Philadelphia, Pa.,	Star Soluble Bone and Potash,	Millville,	7.31	8.01	3.15	1.17	2.27	14 92	22 00	1225
1246	" " " "	Allen's Alkaline Bone Phos.,	Somerset,	5.83	8.17	3.41	0.80	2.42	15 22	19 00	1246
785	Virginia—Carolina Chem.Co., Richmond, Va.,	Standard Bone and Potash,	Hanover,	10.62	7.11	3.14	1.28	2.10	14 14	15 00	785
724	Joshua Walker, Baltimore, Md.,	Victoria Bone,	McKnightstown,	11.76	7.54	5.62	1.47	1.28	15 16	12 50	724
1171	M. E. Wheeler & Co., Rutland, Vt.,	Grass and Oats Fertilizer,	New Washington,	7.96	8.89	3.10	0.59	2.42	15 48	20 00	1171
1209	" " " "	Fruit Grower,	Jacksville,	8.59	5.75	4.71	0.75	9.03	21 42	23 00	1209
1017	Williams & Clark Fertilizer Co., New York,	Dissolved Bone and Potash,	Saltsburg,	7.66	8.96	2.75	1.53	2.27	15 50	20 00	1017
902	Robt. A. Wooldridge Fert.Co., Baltimore, Md.,	Bone and Potash Mixture,	Hay's Grove,	9.45	7.34	4.31	1.07	1.95	14 77	16 65	902
743	Joseph Wolf, Abbottstown, Pa.,	Thirteen Dollars Phosphate,	Abbottstown,	8.56	4.59	3.73	0.45	1.02	11 18	13 00	743
571	Zell Guano Co., Baltimore, Md.,	Electric Phosphate,	Sipesville,	12.86	8.87	2.67	0.93	1.71	14 55	20 00	571
704	" " "	Dis. Bone Phosphate, with Pot.,	Table Rock,	10.97	10.87	3.48	1.15	0.85	15 66	13 00	704

DISSOLVED BONE FERTILIZERS.

Containing Phosphoric Acid and Nitrogen.

From Samples Selected from August 1, 1897 to January 1, 1898.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1375	Armour Fertilizer Works, Chicago, Ill., ..	Bone and Blood, ...	Butler, ...	4.95	0.28	4.07	5.51	6.98	$35 82	$30 00	1375
682	Baugh & Sons' Co., Philadelphia, Pa., ...	Dissolved Animal Bone, ...	Delta, ...	4.71	2.33	12.07	4.30	2.82	32 24	27 00	682
575	Bowker Fertilizer Co., Boston and N. Y.,	Ammoniated O. I. O. Phos., ..	Upper Bern, ...	4.30	8.53	4.64	2.00	0.85	16 89	13 00	575
828	Cambria Fertilizer Co., Johnstown, Pa., ..	Lion Ammoniated Bone Phos.	Wilmore, ...	4.24	5.52	6.15	3.42	2.33	28 64	29 00	828
1052	Chemical Co. of Canton, Baltimore, Md.,	Dissolved Ammoniated Bone, ..	Littlestown, ...	7.14	7.91	2.86	3.27	1.84	24 85	23 00	1052
1320	E. A. Clendennin & Bro., Colora, Md., ...	Pure Dissolved Bone, ...	Nottingham, ...	7.46	6.14	5.48	3.96	1.75	25 70	25 00	1320
878	Cleveland Dryer Co., Cleveland, O., ...	Forest City Bone Phosphate, ..	Greensboro, ...	8.95	6.84	2.47	2.86	2.32	24 28	30 00	878
879	" " " "	Buckeye Ammoniated Bone, ..	Greensboro, ...	9.97	7.27	2.39	2.96	1.96	23 62	30 00	879
885	" " " "	Ohio Seed Maker, ...	Greensboro, ...	8.43	5.95	3.49	3.55	1.18	22 20	26 00	885
1366	" " " "	Square Bone, ...	New Sheffield, ...	2.85	5.96	4.98	5.88	2.79	29 28	29 00	1366
1487	" " " "	Buckeye Ammoniated Bone, ..	Zelienople, ...	5.33	5.79	4.27	4.86	1.59	23 66	28 00	1487
917	Cumberland County Fert. Co., Carlisle, Pa..	Dissolved Animal Bone, ...	Greason, ...	3.69	4.50	5.01	3.01	2.30	24 31	28 00	917
1259	Detrick Fert. & Chem. Co., Baltimore, Md..	Wheat Fertilizer, ...	Williamson, ...	4.89	10.19	1.52	1.93	1.17	24 46	21 00	1259
1094	S. M. Hess & Bro., Philadelphia, Pa., ...	Keystone Bone Phosphate, ...	Washingtonville, ...	5.93	7.83	3.12	1.94	0.99	23 58	18 00	1094

DISSOLVED BONE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1501	Keystone Chem. Mfg. Co., Camden, N. J.,	Ammoniated Bone, ...	Fort Washington, ...	6.06	6.69	6.38	1.53	1.71	27 36	25 00	1501
715	F. Mehring, Bruceville, Md., ...	Dissolved Raw Bone, ...	Biglerville, ...	3.12	4.74	13.56	3.27	1.24	31 50	30 00	715
897	Miller Fertilizer Co., Baltimore, Md., ...	Dissolved Raw Bone, ...	Asper's Station, ...	4.02	8.25	2.36	4.77	2.37	27 12	28 00	897
667	North Western Fertilizer Co., Chicago, Ill.,	Horseshoe Acidulated Bone, ...	Red Lion, ...	7.25	7.97	4.14	3.19	0.96	23 41	20 00	667
1025	R. H. Pollock, Baltimore, Md., ...	Dissolved Animal Bone, ...	Indiana, ...	8.31	8.32	4.59	3.38	2.28	28 04	29 00	1025
1264	Ramsberg Fertilizer Co., Frederick Md., ..	Dissolved Animal Bone, ...	Greencastle, ...	5.62	9.31	3.73	6.25	1.75	28 86	24 00	1264
894	Rasin Fertilizer Co., Baltimore, Md., ...	Dissolved Bone, ...	Asper's Station, ...	7.34	8.37	3.50	2.65	2.20	27 09	21 50	894
1049	Susquehanna Fertilizer Co., Baltimore, Md.,	Pure Dissolved Bone, ...	Littlestown, ...	5.37	8.18	3.07	7.00	2.11	29 30	27 00	1049

GROUND BONE.

Containing Phosphoric Acid and Nitrogen.

From Samples Selected from August 1, 1897 to January 1, 1898.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Insoluble phosphoric acid.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
567	Armour Fertilizer Works, Chicago, Ill., ..	Bone Meal, ...	Addison, ...	4.86	26.94	2.85	$30 84	$30 00	567
661	Baugh & Sons' Co., Philadelphia, Pa., ...	Bone Meal, ...	Red Lion, ...	7.51	22.91	3.96	30 37	27 00	661
1280	" " " "	Bone Meal, ...	Toughkenamon, ...	7.25	23.04	3.95	30 88	25 00	1280
1288	" " " "	Domestic Animal Bone Dust,	Rosedale, ...	4.90	28.36	2.24	30 44	22 00	1288
1120	Albert Baxter, Chester, Pa., ...	Pure Ground Bone, ...	Ogden, ...	4.96	23.98	3.38	28 04	26 00	1120
1291	The Berg Co., Philadelphia, Pa., ...	Raw Bone, Fine, ...	Fairville, ...	7.21	22.95	4.15	26 22	25 00	1291
796	E. K. Bollinger, Sells' Station, Pa., ...	Raw Bone Meal, ...	Hanover, ...	6.07	22.80	4.13	29 91	27 00	796
829	Cambria Fertilizer Co., Johnstown, Pa., ..	Pure Fine Ground Bone Dust,	Willmore, ...	7.10	22.72	3.96	27 01	30 00	829
1252	Chemical Co. of Canton, Baltimore, Md.,	Pure Ground Animal Bone, ...	Chambersburg, ...	5.80	20.14	3.19	27 81	30 00	1252
701	Claremont Abbatoir Co., Baltimore, Md.,	Pure Ground Bone, ...	New Oxford, ...	7.38	23 95	4.02	28 52	27 00	701
882	Cleveland Dryer Co., Cleveland, Ohio, ...	Superior Bone Meal, ...	Greensboro, ...	5.58	22.23	3.41	27 88	32 00	882
1293	Josiah Cope & Co., Lincoln University, Pa.,	Pure Steamed Bone, ...	Fairville, ...	4.30	29.87	1.83	30 94	23 00	1293

GROUND BONE—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Insoluble phosphoric acid.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1207	Crocker Fert. & Chem. Co., Buffalo, N. Y.,	Bone Meal,	Jacksville,	4.40	27.39	2.71	30 57	27 00	1207
1365	" " " "	Ground Bone Meal,	Woodlawn,	3.58	26.31	2.99	31 53	28 00	1365
916	Cumberland County Fert. Co., Carlisle, Pa.,	Pure Raw Animal Bone,	Greason,	6.78	20.37	3.95	25 76	30 00	916
1214	Cumberland Bone Phos. Co., Boston, Mass.,	Extra Fine Ground Bone,	Middle Lancaster,	7.06	15.10	2.19	20 23	30 00	1214
836	Eureka Fertilizer Co., Perryville, Md.,	Bone Meal,	Bradley Junction,	3.85	26.65	2.83	29 44	27 00	826
1249	" " " "	Ground Raw Bone,	West Chester,	5.97	22.81	4.21	28 39	26 00	1249
1251	" " " "	Fine Ground Raw Bone,	Londongrove,	4.68	25.69	3.44	31 40	26 00	1251
1507	Joseph R. Gawthrop, Kennett Square, Pa.,	Fine Ground Bone,	Concord,	5.04	19.88	3.53	26 56	25 00	1507
931	Great Eastern Fertilizer Co., Rutland, Vt.,	Pure Steamed Bone,	Mechanicsburg,	3.65	30.66	2.03	31 83	28 00	931
932	" " " "	Ground Bone,	Mechanicsburg,	4.44	26.20	2.65	31 02	28 00	932
1253	S. M. Hess & Bro., Philadelphia, Pa.,	Ground Bone,	Chambersburg,	5.29	26.41	2.47	30 48	29 00	1253
1230	Hubbard & Co., Baltimore, Md.,	Pure Raw Bone,	Millville,	7.08	23.69	3.64	27 60	30 00	1230
685	Lazaretto Guano Co., Baltimore, Md.,	Pure Ground Animal Bone,	Delta,	7.36	23.30	4.10	27 03	25 00	685
1027	Lister's Agr'l Chem. Works, Newark, N. J.,	Pure Raw Bone Meal,	Indiana,	3.94	24.71	2.90	28 35	28 00	1027
1326	" " " "	Celebrated Ground Bone,	Nottingham,	3.62	14.87	3.21	20 56	24 00	1326
692	Noah Markle, Seitzland, Pa.,	Pure Fine Ground Bone,	Seitzland,	7.56	19.58	5.08	26 35	25 00	692
564	Michigan Carbon Works, Detroit, Mich.,	Dessicated Bone,	Glade,	3.62	31 22	1.35	31 72	24 00	564

598	Milson Rend'g & Fert. Co., Buffalo, N. Y.,	Bone Meal,	Sandy Lake,	3.95	20.31	2.54	25 08	34 00	598
568	North Western Fert. Co., Chicago, Ill.,	Raw Bone,	Somerfield,	6.56	22.96	3.86	29 94	30 00	568
646	Packers' Union Fertilizer Co., New York,	Pure Raw Bone,	Lewisburg,	7.01	21.71	3.98	26 92	28 00	646
647	" " " "	Tankage,	Lewisburg,	7.90	9.41	7.14	26 38	23 00	647
1295	Pugh & Lyon, Oxford, Pa.,	Ground Raw Bone,	Oxford,	6.29	22.98	4.13	28 89	26 00	1295
886	Pittsburg Provision Co., Pittsburg, Pa.,	Butchers' Ground Bone,	Claysville,	3.44	19.31	3.92	27 56	25 00	886
1400	" " " "	No. 1. Pure Raw Bone Meal,	Pittsburg,	5.06	26.34	3.07	29 38	30 00	1400
1026	R. H. Pollock, Baltimore, Md.,	Soft Ground Bone,	Indiana,	6.17	16.36	3.02	22 20	29 00	1026
1159	J. Pie & Co., Osceola, Pa.,	Pure Ground Bone,	Osceola,	6.07	23.66	3.91	27 97	28 00	1159
939	Quinnipiac Co., New York,	Uncas Bone Meal,	Red Top,	2.70	17.20	1.67	20 82	26 00	939
1340	Sharpless & Carpenter, Philadelphia, Pa.,	Pure Bone Meal,	Everett,	6.64	22.91	2.84	28 06	29 00	1340
1141	M. L. Shoemaker & Co., Philadelphia, Pa.,	Pure Raw Bone Meal,	Elk View,	6.73	23.23	4.30	30 48	25 00	1141
1495	John Straining, Harrisburg, Pa.,	Bone and Meat,	Harrisburg,	5.21	3.51	1.07	8 35	15 00	1495
1050	Susquehanna Fertilizer Co., Baltimore, Md.,	Pure Ground Bone,	Littlestown,	7.67	23.48	3.87	28 89	27 00	1050
606	Swift & Co., Chicago, Illinois,	Raw Bone Meal,	Union City,	6.39	25.43	3.89	30 76	28 00	606
1124	" " "	Ground Steamed Bone,	Ogden,	4.89	25.87	3.56	31 27	28 00	1124
1167	Tygert—Allen Fert. Co., Philadephia, Pa.,	Prairie Bone Meal,	Grampian,	6.27	18.87	3.03	24 18	30 00	1167
1143	Emil Wahl, Philadelphia, Pa.,	Button Bone Dust,	West Grove,	7.46	27.06	3.52	31 86	25 00	1143
1423	" " "	Pure Bone,	Gwynedd,	7.78	26.86	3.57	30 58	32 00	1423
608	Walker, Stratman & Co., Pittsburg, Pa.,	Butchers' Bone Meal,	Union City,	4.34	15.88	3.02	22 35	28 00	608
1389	" " " "	Welcome Br'd Pure Raw Bone,	Pittsburg,	5.52	23.67	3.81	30 55	28 00	1389
1134	M. E. Wheeler & Co., Rutland, Vt.,	Pure Ground Bone,	New London,	5.50	20.14	3.18	25 10	26 00	1134
1053	Zell Guano Co., Baltimore, Md.,	Pure Ground Raw Bone,	Littlestown,	6.75	19.10	5.35	29 86	28 00	1053

ACIDULATED SOUTH CAROLINA ROCK.

Containing Phosphoric Acid Only.

From Samples Selected from August 1, 1897 to January 1, 1898.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid	Reverted phosphoric acid.	Insoluble phosphoric acid.	Total phosphoric acid.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
876	American Fert. Co., Washington, D. C.,	Natural Plant Food, ...	West Newton, ...	3.30	.....	2.63	21.65	24.28	$12 60	$16 00	876
956	R. S. Aucker, Shamokin, Pa., ...	High Grade Acid Phosphate, ..	Snydertown, ...	8.52	10.44	5.57	0.57	16.58	14 29	12 00	956
1335	U. & A. C. Blackburn, Fishertown, Pa., ..	Super-Phosphate, ...	Schellsburg, ...	8.96	10.72	4.67	0.57	15.96	13 94	13 00	1335
980	D. Blocher & Co., Gettysburg, Pa., ...	Dissolved S. C. Phosphate, ...	Three Springs, ...	5.52	13.22	4.44	0.38	18.04	15 52	13 00	980
1349	" " "	Dissolved Bone Phosphate, ...	Everett, ...	5.30	13.13	2.89	1.63	17.65	14 98	11 00	1349
643	Bowker Fertilizer Co., Boston and N. Y.,	Super-Phosphate, ...	Winfield, ...	5.86	9.43	4.86	2.78	17.07	13 92	17 00	643
821	Bradley Fertilizer Co., Boston, Mass., ...	Dissolved Bone, ...	Johnstown, ...	5.82	8.03	5.53	1.90	15.46	12 98	17 00	821
1111	" " " "	Dissolved Bone, ...	Watsontown, ...	8.21	5.99	6.45	2.62	15.06	12 53	15 00	1111
1168	" " " "	Acid Phosphate, ...	Grampian, ...	3.36	9.34	3.35	0.46	13.15	12 12	15 00	1168
1039	A. R. Brodbeck, Hanover, Pa., ...	Soluble Bone, ...	Dillsburg, ...	5.32	10.78	6.00	0.66	17.44	14 82	16 00	1039
745	S. B. Brodbeck, Brodbecks', Pa., ...	De C. Ruth's Dis. Bone Phos.,	York, ...	7.95	11.05	4.76	1.00	16.81	14 37	12 50	745
630	Chemical Co. of Canton, Baltimore, Md.,	Baker's Dis. Bone Phosphate,	Shade Gap, ...	8.84	10.04	5.31	0.97	16.32	13 96	14 00	630
584	" " " "	Gem Phosphate, ...	Greensboro, ...	4.48	10.40	4.78	1.33	16.51	14 04	14 00	584
1462	R. L. Christie & Co., Baltimore, Md., ...	Unexcelled Acid Phosphate, ..	Fairmount, ...	6.14	10.46	5.18	0.78	16.42	14 12	10 50	1462

1321	E. A. Clendennin & Bro., Colora, Md., ...	Soluble Bone Phosphate, ...	Nottingham, ...	9.51	6.91	4.09	2.75	13.75	11 62	13 00	1321
1371	" " " "	T. & P. Super-Phosphate, ...	Sarvers' Station, ...	4.68	13.30	2.51	1.00	16.81	14 64	16 00	1371
880	Cleveland Dryer Co., Cleveland, Ohio, ...	XXX Phosphate, ...	Greensboro'	10.06	9.43	6.50	0.56	16.49	14 11	20 00	880
881	" " " "	Horse-head Brand, ...	Greensboro'	10.05	9.70	5.79	0.65	16.14	13 90	16 00	881
1098	E. Frank Coe Co., New York, ...	High Grade Soluble Bone, ...	Mooresburg, ...	12.95	10.04	4.01	2.07	16.12	13 58	14 00	1098
1387	" " "	High Grade Soluble Bone, ...	Kittanning, ...	6.72	9.22	4.30	2.67	16.19	13 40	17 00	1387
1276	Henry Cope & Co., Lincoln University, Pa.,	Acid Phosphate, ...	West Grove, ...	10.21	11.00	4.94	0.51	16.45	14 28	10 50	1276
1292	Josiah Cope & Co., Lincoln University, Pa.,	Acidulated Phosphate, ...	Fairville, ...	9.23	11.32	4.36	0.74	16.42	14 23	10 00	1292
1109	J. A. Cranston Co., Newport, Delaware, ...	Horseshoe Soluble Bone, ...	Bloomsburg, ...	2.93	10.14	4.19	2.68	17.01	13 99	14 00	1109
795	Wm. Davison & Co., Baltimore, Md., ...	South Carolina Bone, ...	Hanover, ...	7.86	9.88	5.16	1.74	16.78	14 06	13 00	795
797	Thomas De C. Ruth, Baltimore, Md., ...	Dissolved Bone, ...	Hanover, ...	8.71	11.99	3.86	1.05	16.90	14 54	11 50	797
979	Louis F. Detrick, Baltimore, Md., ...	Extra Acid Phosphate, ...	Mifflinburg, ...	6.04	13.72	2.54	0.80	17.06	14 89	12 00	979
1263	P. P. Dunan, Baltimore, Md., ...	Dissolved Bone Phosphate, ...	Mercersburg, ...	6.63	12.65	3.40	1.28	17.33	14 82	11 00	1263
834	Eureka Fertilizer Co., Perryville, Md., ...	P. & P. Super-Phosphate, ...	Bradley Junction, ...	9.71	10.16	3.37	3.02	16.55	13 63	14 25	834
1250	" " " "	P. & P. Super-Phosphate, ...	West Chester, ...	14.30	11.79	2.00	2.10	15.89	13 65	11 50	1250
736	Farmers' Fertilizer Co., Westminster, Md.,	Acid Phosphate, ...	New Oxford, ...	5.43	10.63	4.47	1.42	16.52	14 05	12 00	736
810	W. S. Farmer & Co., Baltimore, Md., ...	Dissolved S. C. Bone, ...	Carrolltown, ...	8.34	12.24	3.64	1.00	16.88	14 58	12 00	810
1057	" " " "	Dissolved S. C. Bone, ...	Littlestown, ...	6.39	13.74	3.53	0.54	17.81	15 40	13 00	1057
1508	Joseph R. Gawthrop, Kennett Square, Pa.,	Acid Phosphate, ...	Concord, ...	13.11	11.38	3.19	1.20	15.77	13 72	11 00	1508
581	Charles V. Geiger, Geiger's Mills, Pa., ...	High Grade Acid Phosphate, ..	Hummelstown, ...	6.08	11.11	3.94	1.30	16.35	14 04	12 50	581
573	Great Eastern Fertilizer Co., Rutland, Vt.,	Dissolved Bone, ...	Shartlesville, ...	10.73	12.75	3.39	0.77	16.91	14 70	13 00	573
1338	S. M. Hess & Bro., Philadelphia, Pa., ...	High Grade Acid Phosphate, ..	Bedford, ...	4.03	8.94	6.97	0.75	16.66	14 10	15 00	1338
1237	Jarecki Chemical Co., Sandusky, Ohio, ...	Wheat Special, ...	Atchison, ...	4.64	11.83	4.35	0.87	17.05	14 66	18 00	1237
808	Lackawanna Fert. & Chem.Co., Moosic, Pa.,	Acid Phosphate, ...	Bradley Junction, ...	5.10	13.03	4.12	0.58	17.73	15 27	13 75	808
616	Liebig Manufacturing Co., New York, ...	High Grade Acid Phosphate, ..	Loveville, ...	9.81	11.32	4.18	1.30	16.80	14 32	14 00	616

ACIDULATED SOUTH CAROLINA ROCK—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Where Selected.	Moisture.	Soluble phosphoric acid	Reverted phosphoric acid.	Insoluble phosphoric acid.	Total phosphoric acid.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
627	Maryland Fertilizing Co., Baltimore, Md.,	Dissolved S. C. Bone,	Huntingdon,	9.35	11.01	4.33	1.68	17.02	14 34	13 00	627
738	" " " "	Dissolved Phosphate,	Abbottstown,	6.88	12.84	3.54	1.10	17.48	14 98	16 00	738
1267	H. P. McLaughlin, State Line, Pa.,	Pure S. C. Rock,	State Line,	6.05	12.80	2.85	1.15	16.80	14 55	12 00	1267
1064	F. Mehring, Bruceville, Md.,	Acid Phosphate,	Littlestown,	6.88	11.91	4.40	3.47	19.78	15 67	13 00	1064
1036	Miller Fertilizer Co., Baltimore, Md.,	S. C. Bone,	Dillsburg,	3.16	12.90	3.40	1.25	17.55	14 98	10 50	1036
777	H. H. Myers, Codorus, Pa.,	Soluble Bone,	Seven Valleys,	5.24	12.81	3.00	1.53	17.34	14 78	12 00	777
1200	Niagara Fert. Works, Buffalo, N. Y.,	Queen City Phosphate,	Murrinsville,	5.55	6.11	6.69	1.53	14.33	12 18	19 00	1200
753	G. Ober & Sons' Co., Baltimore, Md.,	Dissolved Bone Phosphate,	York,	6.20	14.32	3.52	0.64	18.48	15 87	12 00	753
989	Pacific Guano Co., New York,	Dissolved Bone Phos. of Lime,	Petersburg,	2.84	13.03	3.18	2.28	18.49	15 33	13 00	989
645	Packers' Union Fertilizer Co., New York,	Acidulated Bone,	Lewisburg,	7.48	12.71	3.96	0.43	17.10	14 89	13 00	645
849	" " " "	Acidulated Bone,	McKee,	6.29	14.04	1.88	0.64	16.56	14 67	14 00	849
1231	Patapsco Guano Co., Baltimore, Md.,	Pure Dissolved S. C. Bone,	Greenwood,	6.63	11.13	4.58	0.80	16.51	14 25	13 00	1231
914	Moro Phillips Chem. Co., Philadelphia, Pa.,	Soluble Bone Phosphate,	Shippensburg,	5.82	10.82	4.17	1.43	16.42	14 00	12 50	914
621	Piedmont—Mt. Airy Guano Co., Balti., Md.,	S. C. Bone Phosphate,	Petersburg,	4.97	10.31	3.99	1.82	16.12	13 66	12 00	621
614	R. H. Pollock, Baltimore, Md.,	Dissolved S. C. Bone,	Loveville,	7.48	10.41	4.83	1.37	16.61	14 10	13 00	614
863	Quinnipiac Company, New York,	Soluble Dissolved Bone,	Newry,	2.33	14.47	2.69	1.65	18.81	15 82	12 00	863
694	Ramsburg Fertilizer Co., Frederick, Md.,	Dissolved Bone Super-Phos.,	Abbottstown,	5.70	12.22	4.80	2.79	19.81	15 87	13 00	694

800	Rasin Fertilizer Co., Baltimore, Md., ...	Acid Phosphate, ...	Carrolltown, ...	7.30	13.59	2.69	1.24	17.52	15 04	13 00	800
887	" " " "	Acid Phosphate, ...	Claysville, ...	6.87	12.80	3.46	0.63	16.89	14 73	15 00	887
655	John S. Reese & Co., Baltimore, Md., ...	Elm Phosphate, ...	Thomasville, ...	10.11	11.66	4.52	0.86	17.04	14 64	14 00	655
1243	" " " "	Dissolved Phosphate of Lime,	Canonsburg, ...	7.14	12.24	3.69	1.14	17.07	14 64	20 00	1243
1287	Scott Fertilizer Co., Elkton, Md., ...	Tip Top Soluble Bone, ...	Rosedale, ...	7.03	11.24	5.05	0.64	16 93	14 58	10 50	1287
1097	G. W. Sharretts & Co., Baltimore, Md., ..	Standard Dis. S. C. Phosphate,	Mooresburg, ...	7.57	12.09	2.84	1.94	16.87	14 31	13 00	1097
1142	M. L. Shoemaker & Co., Philadelphia, Pa.,	Dissolved S. C. Rock, ...	Elk View, ...	11.72	11.86	2.55	1.20	15.61	13 70	12 00	1142
847	Standard Fertilizer Co., Boston, Mass, ...	Standard Dis. Bone Phosphate,	Hollidaysburg, ...	3.62	13.92	3.39	1.37	18.68	15 78	13 00	847
846	Susquehanna Fertilizer Co., Baltimore, Md.,	Soluble Bone Phosphate, ...	Hollidaysburg, ...	5.05	13.40	2.73	1.39	17.52	14 97	13 00	846
593	I. P. Thomas & Son Co., Philadelphia, Pa.,	S. C. Phosphate, ...	Shartlesville, ...	2.06	13.09	3.43	2.05	18.57	15 42	12 00	593
1165	Tygert—Allen Fert. Co., Philadelphia, Pa.,	High Grade Dis. S. C. Bone,	Grampian, ...	3.37	13.21	2.84	0.65	16.70	14 66	15 00	1165
1226	" " " "	Dissolved Bone Phosphate, ...	Millville, ...	7.83	13.40	2.73	0.66	16.79	14 74	12 00	1226
1257	" " " "	W'lt'n&Whann's XX Acid Ph.,	Guilford Springs, ...	4.56	13.41	2.41	0.74	16.56	14 56	11 00	1257
787	Virginia—Carolina Chem.Co.,Richmond,Va.,	Guar. 14 per cent. Acid Phos.,	Hanover, ...	3.15	12.56	3.21	1.80	17.57	14 80	12 50	787
1394	Walker, Stratman & Co., Pittsburg, Pa.,	Welcome Br'd,Helpmate Phos.,	Pittsburg, ...	2.89	8.22	5.12	0.87	14.21	12 51	17 00	1394
1137	John Whann & Son, Philadelphia, Pa., ..	A. A. Acid Phosphate, ...	Kelton, ...	9.90	11.47	3.90	0.33	15.70	13 92	14 00	1137
1135	M. E. Wheeler & Co., Rutland, Vermont, ..	Electrical Dissolved Bone, ...	New London, ...	3.64	13.98	2.70	0.87	17.55	15 21	12 00	1135
560	Williams & Clark Fertilizer Co., New York,	Acorn Brand Acid Phosphate,	Somerset, ...	9.17	12.55	3.64	1.39	17.58	14 94	14 00	560
913	" " " "	Plain Dissolved Bone, ...	Leesburg, ...	4.12	12.90	3.05	2.03	17.98	15 07	15 00	913
1016	" " " "	Acorn Brand Acid Phosphate,	Saltsburg, ...	2.42	13.28	2.80	2.56	18.64	15 38	16 00	1016
1367	" " " "	Acorn Brand Acid Phosphate,	Green Garden, ...	2.31	14.11	2.56	3.73	20.40	16 24	13 00	1367
1008	Robert A. Woolridge Co., Baltimore, Md.,	XXTra Acid Phosphate, ...	Black Lick, ...	5.49	10.53	4.48	1.09	16.10	13 87	12 00	1008
1153	York Chemical Works, York, Pa., ...	Dissolved S. C. Phosphate, ...	Monaghan, ...	14.10	11.55	4.03	0.75	16.33	14 23	14 00	1153
637	Zell Guano Co., Baltimore, Md., ...	Dissolved Bone Phosphate, ...	Williamsburg, ...	3.80	13.33	2.33	1.90	17.56	14 88	11 25	637
642	" " "	Dissolved S. C. Bone, ...	Winfield, ...	4.01	9.87	5.99	1.75	17.61	14 53	11 00	642
860	" " "	Dissolved Bone Phosphate, ...	Winfield, ...	3.45	10.63	6.12	0.94	17.69	14 88	12 50	860

ANALYSES OF COMPOSITE SAMPLES.

COMPLETE FERTILIZERS.

CONTAINING PHOSPHORIC ACID, POTASH AND NITROGEN.

Samples Selected from August 1, 1897 to January 1, 1898.

The samples in the preceding tables are selected by seven special agents of the Department who work independently of each other; this necessarily causes a duplication of samples, and in some few cases, six samples of the same brand are sent in by as many different agents. After all the regular samples have been analyzed and reported upon, the chemist forms "composite" samples by mixing all the samples of the same brand, and taking the "composite" sample from the mixture. The analyses which follow are those of "composite" samples obtained in this manner, and fairly represent the average of all the samples of the same brand.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1512	American Reduction Co., Pittsburg, Pa., ..	Common Sense Brand, ...	Three, ...	5.81	2.44	2.10	0.68	1.03	2.13	$18 87	$17 00	1512
1513	" " " " ..	Pouter Brand, ...	Two, ...	4.06	2.64	2.58	3.36	2.06	1.85	21 19	24 00	1513
1515	Armour Fertilizer Works, Chicago, Ill., ..	Ammoniated Bone with Potash,	Four, ...	3.28	2.74	4.61	4.08	1.64	2.82	26 91	27 00	1515
1516	" " " " ..	Grain Grower, ...	Five, ...	4.63	4.17	5.24	5.65	2.42	2.63	30 39	23 00	1516
1517	Baltimore Guano Co., Baltimore, Md., ...	Game Guano, ...	Two, ...	5.57	5.86	3.30	2.48	2.97	3.22	27 53	24 50	1517
1520	Baugh & Sons' Co., Gettysburg, Pa., ...	Double Eagle Phosphate, ...	Two, ...	9.70	4.48	5.19	3.42	0.84	2.23	26 70	24 25	1520
1522	D. Blocher & Co., Gettysburg, Pa., ...	Dis. Raw Bone and Potash, ..	Three, ...	8.31	7.22	3.96	0.87	2.84	2.02	28 93	23 67	1522

1524	Bowker Fertilizer Co., Boston & New York,	Sure Crop Phosphate, ...	Five, ...	5.97	4.50	5.54	3.96	1.22	1.03	24 08	25 00	1524
1527	Bradley Fertilizer Co., Boston, Mass., ...	Dissolved Bone with Potash, ..	Three, ...	10.52	4.03	5.01	2.00	2.78	1.15	23 60	28 00	1527
1528	" " " "	Niagara Phosphate, ...	Three, ...	8.20	4.73	4.02	1.85	1.66	1.21	22 18	23 50	1528
1529	" " " "	Sea Fowl Guano, ...	Two, ...	9.64	4.14	5.59	2.65	1.64	2.29	27 39	32 50	1529
1533	Chemical Co. of Canton, Baltimore, Md.,	B'k'r's Sp'lWh't,C'n&Gr'sMix.,	Six, ...	5.69	4.69	4.50	2.29	2.33	1.06	23 18	22 17	1533
1537	" " " "	Baker's Standard High Grade,	Three, ...	8.66	6.80	2.53	2.22	2.99	1.83	26 95	26 67	1537
1538	" " " "	Harrow Brand, ...	Two, ...	9.03	4.85	3.96	2.11	2.24	0.85	21 85	16 50	1538
1540	" " " "	Red Clover, for Wheat&Grass,	Three, ...	4.65	2.55	3.81	1.92	1.88	0.87	18 18	20 00	1540
1543	Clark's Cove Fertilizer Co., New York, ...	Defiance Complete Manure, ...	Two, ...	9.35	3.84	4.80	2.35	2.01	1.23	22 74	21.50	1543
1544	" " " "	King Philip Alkaline Guano, ..	Three, ...	13.77	3.34	2.86	2.11	3.08	1.60	21 98	24 17	1544
1547	Cleveland Dryer Co., Cleveland, Ohio, ...	Ohio Seed Maker, ...	Two, ...	8.66	6.91	3.76	2.63	1.04	1.16	24 28	25 50	1547
1548	E. Frank Coe Company, New York, ...	Grass and Grain Fertilizer, .	Two, ...	7.30	7.83	3.96	2.48	1.78	1.13	26 71	25 00	1548
1551	Josiah Cope & Co., Lincoln University, Pa.,	Try Me Bone Phosphate, ...	Two, ...	6.86	7.54	3.15	2.15	5.49	1.48	30 46	24 00	1551
1552	" " " "	Pure Bone Phosphate, ...	Two, ...	6.85	4.06	4.88	4.22	3.59	2.12	28 59	26 50	1552
1554	Crocker Fert. & Chem. Co., Buffalo, N. Y.,	New Rival Ammoniated Phos.,	Four, ...	6.72	7.36	3.41	1.37	1.89	1.83	27 13	26 67	1554
1557	" " " "	Potato, Hop & Tobacco Phos.,	Two, ...	6.93	8.50	3.20	0.80	3.28	2.06	30 30	31 00	1557
1558	" " " "	Universal Grain Grower, ...	Three, ...	4.71	5.17	2.92	1.48	3.43	0.96	22 33	24 25	1558
1561	Louis F. Detrick, Baltimore, Md., ...	Kangaroo Komplete Kompo'nd,	Three, ...	6.66	7.36	2.93	2.41	3.11	1.70	27 86	24 00	1561
1567	Eureka Fertilizer Co., Perryville, Md., ...	Farmers' Favorite Bone Phos.,	Three, ...	7.00	7.29	3.67	2.46	1.57	1.18	25 30	23 00	1567
1568	" " " "	Grain and Grass Mixture, ...	Three, ...	10.06	7.09	4.17	2.63	1.95	0.56	25 33	20 00	1568
1570	Joseph R. Gawthrop, Kennett Square, Pa.,	Complete Am. Bone Phosphate,	Two, ...	3.68	5.83	2.64	3.41	3.62	1.64	26 74	25 00	1570
1577	Griffith & Boyd, Baltimore, Md., ...	Cereal Plant Food, ...	Two, ...	9.25	5.03	3.48	2.11	2.57	0.82	21 67	20 00	1577
1578	" " "	Valley Fertilizer, ...	Two, ...	8.73	5.04	3.26	1.99	3.01	0.48	15 63	16 50	1578
1572	Great Eastern Fertilizer Co., Rutland, Vt.,	General Fertilizer, ...	Two, ...	8.30	4.90	4.93	1.15	3.84	1.06	25 05	22 50	1572

COMPLETE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1573	" " " "	Wheat Special, ...	Two, ...	8.66	3.60	5.93	1.54	2.11	1.68	24 96	22 00	1573
1574	" " " "	English Wheat Grower, ...	Two, ...	8.43	3.28	7.25	1.40	2.41	0.91	23 74	20 50	1574
1579	S. M. Hess & Bro., Philadelphia, Pa., ...	Keystone Bone Phosphate, ...	Two, ...	5.65	3.23	9.00	1.47	0.68	0.93	24 14	18 67	1579
1582	Hubbard & Co., Baltimore, Md., ...	Wheat Growers' Jewel, ...	Two, ...	7.13	8.17	4.14	1.45	1.66	1.34	27 16	21 50	1582
1583	M. P. Hubbard & Co., Baltimore, Md., ...	Harvest King, ...	Two, ...	6.55	6.79	2.46	1.63	1.47	1.50	23 72	19 75	1583
1585	Lister's Agri. Chem. Works, Newark, N. J.,	Success Fertilizer, ...	Three, ...	7.59	8.00	3.46	1.75	2.10	1.38	26 91	25 33	1585
1586	" " " "	Harvest Queen, ...	Three, ...	7.61	7.71	3.96	1.75	1.97	1.42	26 96	24 67	1586
1588	" " " "	Special Potato Fertilizer, ...	Three, ...	6.68	7.02	2.79	1.81	4.63	2.56	31 46	27 25	1588
1590	" " " "	Special Fertilizer for Wheat, ..	Three, ...	5.59	6.40	3.30	2.73	1.99	1.51	25 33	31 00	1590
1591	" " " "	Special Crop Producer, ...	Two, ...	3.81	3.92	3.64	3.16	1.24	0.99	20.16	19 50	1591
1592	Mapes' Formula & Peruv'n Guano Co., N.Y.,	Cereal Brand, ...	Four, ...	6.06	4.55	2.75	2.28	3.47	2.22	25 94	27 25	1592
1593	" " " "	Complete Manure, "A" Brand,	Two, ...	7.22	4.18	3.66	5.38	3.69	2.99	30 97	34 00	1593
1597	Maryland Fertilizing Co., Baltimore, Md.,	Ammoniated Bone, ...	Two, ...	8.56	7.02	2.20	3.48	2.07	1.96	26 73	25 50	1597
1598	" " " "	Ammoniated O. K. Fertilizer,	Two, ...	10.01	7.09	1.78	2.35	1.84	1.42	23 71	19 50	1598
1600	Michigan Carbon Works, Detroit, Mich., ..	Homestead Fertilizer, ...	Two, ...	7.15	7.50	2.41	1.28	2.34	2.39	28 51	27 00	1600
1602	Milsom Ren'g & Fert. Co., Buffalo, N. Y.,	Buffalo Fertilizer, ...	Two, ...	7.08	6.72	2.02	2.41	1.33	1.86	24 55	26 50	1602
1603	" " " "	Wheat, Oats and Barley, ...	Five, ...	5.41	5.96	2.32	2.54	1.66	1.31	22 48	24 50	1603

1604	" " " "	Erie King,	Three,	4.81	5.12	2.49	1.81	1.51	0.97	19 89	21 07	1604
1605	Wm. C. Newport Co., Willow Grove, Pa.,	Rectified Phosphate,	Two,	6.41	4.66	3.35	5.58	4.87	2.82	31 90	33 00	1605
1608	North Western Fertilizer Co., Chicago, Ill.,	Ammoniated Dissolved Bone,	Two,	5.29	5.46	3.52	2.73	1.09	3.53	30 37	27 00	1608
1611	Oakfield Fertilizer Co., Buffalo, N. Y.,	Great Value Fertilizer,	Two,	11.96	3.38	4.49	0.78	1.32	1.06	19 58	20 50	1611
1612	" " " "	High Farming Fertilizer,	Two,	11.90	5.08	2.95	1.83	2.71	2.10	25 53	29 00	1612
1613	" " " "	Golden Sheaf Fertilizer,	Four,	11.23	4.72	3.52	1.05	2.21	1.45	22 83	23 25	1613
1614	" " " "	Standard Fertilizer,	Two,	6.69	6.81	3.71	1.95	2.11	2.70	30 09	33 00	1614
1616	Pacific Guano Co., New York,	A. No. 1 Phosphate,	Two,	10.33	3.88	5.02	2.83	2.09	1.40	23 89	21 50	1616
1621	Packers' Union Fertilizer Co., New York,	Wheat, Oats & Clover Fert.,	Four,	6.69	7.50	3.22	1.40	2.84	0.66	24 08	18 00	1621
1619	Patapsco Guano Co., Baltimore, Md.,	Grain and Grass Producer,	Two,	10.75	7.66	2.78	1.29	2.76	1.01	24 82	21 00	1619
1623	" " " "	Grange Mixture,	Two,	6.32	6.93	3.86	0.57	2.65	1.66	26 88	22 00	1623
1625	Mcro Phillips Chem. Co., Philadelphia, Pa.,	Farmers' Phosphate,	Two,	7.48	5.45	2.79	1.45	1.55	0.68	19 69	16 00	1625
1626	" " " "	C. & G. Complete Fertilizer,	Two,	9.60	5.23	2.65	1.79	1.53	1.04	20 59	19 75	1626
1628	Pittsburg Provision Co., Pittsburg, Pa.,	Keystone Fertilizer,	Three,	2.37	2.84	4.75	3.79	1.09	1.66	22 56	25 33	1628
1633	Powell Fert. & Chem. Co., Baltimore, Md.,	Red Bag Fertilizer,	Two,	4.24	3.24	6.05	3.89	2.63	1.03	24 22	19 75	1633
1635	Quinnipiac Co., New York,	Mohawk Fertilizer,	Three,	8.49	2.79	5.25	3.09	1.20	1.13	21 04	21 83	1635
1637	" " "	Climax Phosphate,	Five,	7.30	3.41	5.70	3.52	2.06	1.41	24 36	22 80	1637
1639	" " "	Ammoniated Dissolved Bone,	Two,	5.78	5.75	4.52	4.10	2.18	2.15	29 12	27 50	1639
1640	Rasin Fertilizer Co., Baltimore, Md.,	Empire Guano,	Four,	8.15	8.65	0.74	3.04	1.94	2.14	27 52	22 75	1640
1644	" " " "	Ammoniated Alkaline Phos.,	Four,	9.20	5.60	4.53	2.87	1.50	1.62	25 62	20 56	1644
1645	" " " "	Ammoniated Super-Phosphate,	Three,	8.36	7.40	5.16	1.76	1.24	0.98	25 90	17 50	1645
1648	Sharpless & Carpenter, Philadelphia, Pa.,	No. 1 Bone Phosphate,	Two,	8.47	7.29	2.51	1.67	2.02	1.75	25 87	28 00	1648
1650	Standard Fertilizer Co., Boston, Mass.,	Standard Guano,	Four,	8.26	5.05	3.41	3.18	2.25	1.22	23 16	23 50	1650
1652	" " " "	Standard A. Brand,	Three,	6.12	5.74	3.31	2.69	1.38	1.22	22 80	25 00	1652
1654	Susquehanna Fertilizer Co., Baltimore, Md.	XXV Phosphate,	Two,	6.50	7.31	3.49	1.65	1.37	1.16	24 36	23 25	1654

COMPLETE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1656	" " " "	Ammoniated Bone Phosphate,	Two,	6.51	7.78	4.01	2.76	2.33	1.85	29 58	23 00	1656
1659	I. P. Thomas & Son Co., Philadelphia, Pa.,	Normal Bone Phosphate,	Three,	6.63	7.95	2.62	2.21	2.06	1.32	25 72	25 00	1659
1660	" " " "	Improved Super-Phosphate,	Four,	5.64	7.90	2.97	2.23	1.91	1.20	25 53	20 50	1660
1661	Tygert—Allen Fert. Co., Philadelphia, Pa.,	Star Bone Phosphate,	Four,	5.49	8.15	1.70	1.81	2.80	2.08	28 15	26 75	1661
1663	Walker, Stratman & Co., Pittsburg, Pa.,	Big Bonanza,	Two,	3.99	9.57	1.95	2.67	2.79	1.97	30 26	28 00	1663
1665	M. E. Wheeler & Co., Rutland, Vermont,	Royal Wheat Grower,	Four,	7.19	6.93	2.01	1.88	2.68	1.08	23 48	22 25	1665
1667	Williams & Clark Fertilizer Co., New York	Royal Bone Phosphate,	Four,	8.32	4.43	5.25	3.16	2.15	1.50	25 46	25 50	1667
1672	Robert A. Wooldridge Co., Baltimore, Md.,	Little Giant,	Four,	7.95	7.15	3.17	1.29	2.23	0.98	24 04	20 54	1672
1673	" " " "	Triumph Brand,	Three,	7.65	7.07	2.20	1.42	4.13	1.28	25 94	23 83	1673
1677	The Zell Guano Co., Baltimore, Md.,	Calvert Guano,	Two,	7.47	8.55	2.64	1.94	1.77	0.85	24 56	19 75	1677
1680	" " " "	The Little Giant,	Three,	6.47	7.43	2.87	1.09	0.98	1.18	23 30	17 33	1680

ALKALINE FERTILIZERS.

COMPOSITE SAMPLES.

Containing Phosphoric Acid and Potash.

From Samples Selected from August 1, 1897 to January 1, 1898.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1523	Bowker Fertilizer Co., Boston & New York,	Super-Phosphate with Potash, ..	Two, ...	4.98	4.18	6.53	4.74	1.04	$12 98	$19 00	1523
1541	Chemical Co. of Canton, Baltimore, Md.,	Soluble Bone and Potash, ...	Three, ...	9.66	1.68	8.12	1.81	2.83	13 86	14 16	1541
1545	Clark's Cove Fertilizer Co., New York, ...	Triumph Bone and Potash, ...	Two, ...	7.96	8.62	2.74	2.05	2.07	15 21	19 00	1545
1553	Josiah Cope & Co., Lincoln University, Pa.,	Soluble Bone and Potash, ...	Two, ...	9.67	6.71	4.96	1.52	2.25	15 20	14 50	1553
1564	Louis F. Detrick, Baltimore, Md., ...	Bone and Potash Mixture, ...	Two, ...	9.34	6.09	5.02	3.20	2.33	15 49	15 00	1564
1565	James G. Downward & Co., Coatesville, Pa.,	Soluble Bone and Potash, ...	Two, ...	12.33	8.52	1.96	0.45	3.73	15 96	17 00	1565
1575	Great Eastern Fertilizer Co., Rutland, Vt.,	Soluble Bone and Potash, ...	Three, ...	8.15	7.18	4.73	1.28	2.04	15 12	17 50	1575
1587	Lister's Agri. Chem. Works, Newark, N. J.,	Animal Bone and Potash, ...	Two, ...	9.41	5.79	4.33	1.02	5.92	17 92	23 50	1587
1594	Maryland Fertilizer Co., Baltimore, Md., ..	Linden Super-Phosphate, ...	Two, ...	9.25	8.60	3.71	2.14	2.32	16 08	18 50	1594
1599	" " " " ..	Bono-Super-Phosphate, ...	Three, ...	9.57	8.29	3.65	1.62	1.87	15 15	16 50	1599
1617	Pacific Guano Co., New York, ...	Dissolved Bone and Potash, ...	Two, ...	6.56	7.40	2.82	2.67	2.12	14 65	16 50	1617
1618	Packers' Union Fertilizer Co., New York,	H.G.Wheat,Oats & Clover Ph.,	Two, ...	6.25	8.57	4.13	0.83	2.24	15 80	15 50	1618
1622	Patapsco Guano Co., Baltimore, Md., ...	Baltimore Soluble Phosphate,	Three, ...	7.75	7.58	4.48	0.97	2.14	15 25	15 00	1622
1632	R. H. Pollock, Baltimore, Md., ...	Victor Bone Phosphate, ...	Two, ...	7.51	7.72	3.30	1.56	1.37	13 99	17 00	1632

ALKALINE FERTILIZERS—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Potash.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1638	Quinnipiac Co., New York, ...	Dissolved Bone and Potash, ..	Four, ...	5.75	5.52	5.82	2.49	2.32	15 26	16 75	1638
1643	Rasin Fertilizer Co., Baltimore, Md., ...	Bone and Potash Fertilizer, ..	Three, ...	8.42	8.00	5.80	1.44	1.22	15 46	16 00	1643
1651	Standard Fertilizer Co., Boston, Mass, ...	Standard Bone and Potash, ...	Two, ...	7.21	5.14	5.38	2.28	2.86	15 24	25 00	1651
1662	Tygert—Allen Fert. Co., Philadelphia, Pa.,	Star Soluble Bone and Potash,	Two, ...	4.75	8.22	3.46	0.89	2.27	15 14	22 00	1662
1666	Williams & Clark Fertilizer Co., New York.	Americus Br. Dis. Bone & Pot.,	Four, ...	4.94	8.41	3.26	2.15	2.14	15 51	17 75	1666
1670	Robert A. Wooldridge Co., Baltimore, Md.,	Bone and Potash Mixture, ...	Two, ...	6.85	8.25	4.29	2.26	1.71	15 57	15 83	1670
1678	Zell Guano Co., Baltimore, Md., ...	Electric Phosphate, ...	Three, ...	8.80	6.79	4.76	2.32	2.03	15 20	17 92	1678

DISSOLVED BONE FERTILIZERS.

COMPOSITE SAMPLES.

Containing Phosphoric Acid and Nitrogen.

Samples Selected from August 1, 1897 to January 1, 1898.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1526	Bowker Fertilizer Co., Boston & New York,	Ammoniated O. I. O. Phos., ...	Two, ...	2.60	6.95	6.62	1.91	0.80	$16 77	$13 50	1526
1642	Rasin Fertilizer Co., Baltimore, Md., ...	Dissolved Bone, ...	Three, ...	6.58	8.36	2.68	3.19	2.18	26 40	23 17	1642
1658	Susquehanna Fertilizer Co., Baltimore, Md.,	Pure Dissolved Bone, ...	Two, ...	5.06	8.22	3.42	6.88	2.08	28 47	26 00	1658

GROUND BONE.

COMPOSITE SAMPLES.

Containing Phosphoric Acid and Nitrogen.

Samples Selected from August 1, 1897 to January 1, 1898.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Insoluble phosphoric acid.	Nitrogen.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1514	Armour's Fertilizer Works, Chicago, Ill.,	Bone Meal,	Three,	4.47	23.78	3.48	$29 06	$28 50	1514
1539	Chemical Co. of Canton, Baltimore, Md.,	Baker's Stand. Ground Bone,	Two,	3.94	17.96	3.43	24 45	25 00	1531
1546	Cleveland Dryer Co., Cleveland, O.,	Superior Bone Meal,	Two,	5.78	22 40	3.40	27 38	31 00	1546
1581	S. M. Hess & Bro., Philadelphia, Pa.,	Ground Bone,	Two,	4.76	26 56	2.50	30 73	29 50	1581
1589	Lister's Agri. Chem. Works, Newark, N. J.,	Pure Raw Bone Meal,	Two,	3.86	25.25	2.72	27 30	28 33	1589
1607	North Western Fertilizer Co., Chicago, Ill.,	Fine Raw Bone,	Two,	6.55	23 78	3.76	29 97	28 50	1607
1627	Pittsburg Provision Co., Pittsburg, Pa.,	Pure Bone Meal,	Two,	4.52	23.55	3.61	29 24	30 00	1627
1631	R. H. Pollock, Baltimore, Md.,	Soft Ground Bone,	Two,	4.46	16.97	2.86	21 94	28 00	1631
1636	Quinnipiac Co., New York,	Uncas Bone Meal,	Two,	2.16	17.51	1.73	21 32	26 50	1636
1647	Scott Fertilizer Co., Elkton, Md.,	Pure Ground Bone,	Two,	6.84	23.07	4.09	26 91	24 75	1647
1657	Susquehanna Fertilizer Co., Baltimore, Md.,	Pure Ground Bone,	Two,	7.08	23.42	3.78	28 24	26 50	1657

ACIDULATED SOUTH CAROLINA ROCK.

COMPOSITE SAMPLES.

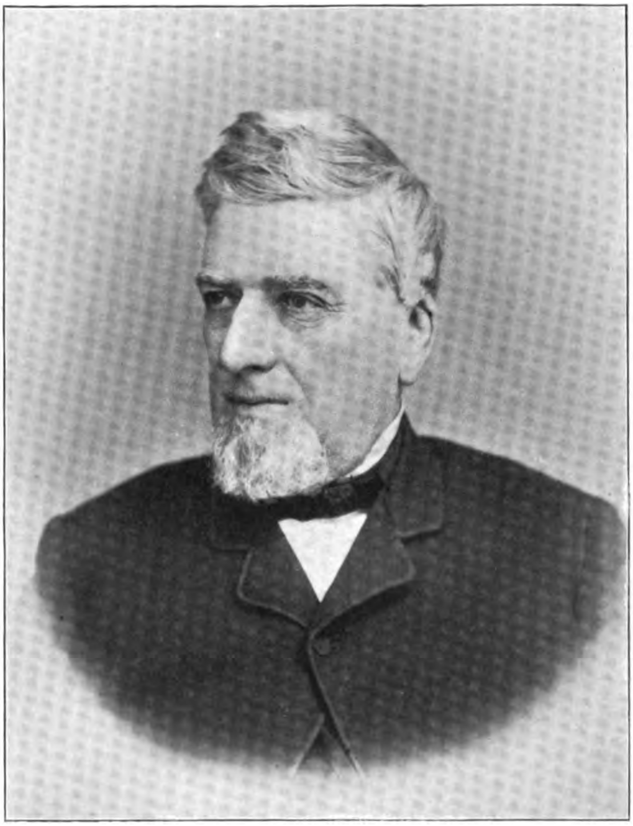
Containing Phosphoric Acid Only.

Samples Selected from August 1, 1897 to January 1, 1898.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Total phosphoric acid.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1518	Baltimore Guano Co., Baltimore, Md., ...	Dissolved Bone Phosphate, ...	Two,	5.26	7.57	7.72	1.30	16.59	$13 76	$14 C0	1518
1523	D. Blocher & Co., Gettysburg, Penna., ...	Dissolved S. C. Bone Phos.,	Two,	5.15	10.78	6.65	0.43	17.86	15 12	12 00	1523
1530	Bradley Fertilizer Co., Boston, Mass., ...	Dissolved Bone,	Three,	5.64	6.42	6.96	1.43	14.81	12 51	20 00	1530
1534	Chemical Co. of Canton, Baltimore, Md.,	Pure Dissolved S. C. Bone, ...	Three,	4.62	10.96	5.00	1.00	16.96	14 44	12 67	1534
1535	" " " "	Gem Phosphate,	Four,	4.73	10.47	5.56	1.00	17.03	14 46	12 63	1535
1536	" " " "	Baker's Dis. Bone Phosphate,	Three,	4.64	10.45	5.23	1.06	16.74	14 26	17 00	1536
1550	Josiah Cope & Co., Lincoln University, Pa.,	Acidulated Phosphate,	Two,	8.17	11.59	3.79	0.51	15.89	14 01	10 50	1550
1560	Detrick Fert. & Chem. Co., Baltimore, Md.,	Dissolved S. C. Bone,	Two,	3.78	13.81	3.17	0.69	17.67	15 28	11 75	1560
1563	Louis F. Detrick, Baltimore, Md.,	XXtra Acid Phosphate,	Two,	4.74	13.41	3.13	0.85	17.39	15 06	11 25	1563
1566	Eureka Fertilizer Co., Perryville, Md., ...	Super-Phosphate,	Three,	2.80	9.49	5.42	1.91	16.82	13 96	11 67	1566
1569	W. S. Farmer & Co., Baltimore, Md., ...	Dissolved S. C. Bone,	Two,	3.72	13.63	3.94	0.68	18.25	15 64	12 38	1569
1571	Joseph R. Gawthrop, Kennett Square, Pa.,	Acid Phosphate,	Two,	10.02	11.38	3.75	0.69	16.42	14 31	10 00	1571
1576	Great Eastern Fertilizer Co., Rutland, Vt.,	General Dissolved Bone, ...	Three,	8.72	10.73	4.75	0.73	16.21	14 05	13 34	1576
1584	Liebig Manufacturing Co., New York, ...	High Grade Acid Phosphate, ..	Two,	7.99	12.45	3.82	0.74	17.01	14 72	12 25	1584

ACIDULATED SOUTH CAROLINA ROCK—Continued.

Sample number.	Name and Address of Manufacturer.	Name of Fertilizer.	Number of Samples Combined.	Moisture.	Soluble phosphoric acid.	Reverted phosphoric acid.	Insoluble phosphoric acid.	Total phosphoric acid.	Comparative commercial value per ton.	Selling price at point of selection per ton.	Sample number.
1595	Maryland Fertilizing Co., Baltimore, Md.,	Dissolved Bone, ...	Two, ...	7.96	13.07	3.34	0.80	17.21	14 90	15 50	1595
1596	" " " "	Dissolved S. C. Bone, ...	Four, ...	7.19	12.34	3.73	1.10	17.17	14 71	12 88	1596
1601	Milsom Rend'g & Fert. Co., Buffalo, N. Y.,	Dissolved Bone, ...	Two, ...	3.50	10.07	3.84	0.67	14.58	13 03	16 00	1601
1615	Pacific Guano Co., New York, ...	Dis. Bone Phosphate of Lime,	Two, ...	1.69	12.94	3.18	2.17	18.29	15 22	12 38	1615
1620	Patapsco Guano Co., Baltimore, Md., ...	Pure Dissolved S. C. Bone, ...	Two, ...	7.91	10.37	4.87	0.89	16.13	13 93	12 83	1620
1624	Moro Phillips Chem. Co., Philadelphia, Pa.,	Soluble Bone Phosphate, ...	Three, ...	5.56	11.01	4.51	0.89	16.41	14 14	12 17	1624
1634	Quinnipiac Co., New York, ...	Soluble Dissolved Bone, ...	Three, ...	2.07	14.05	3.06	1.34	18.45	15 64	12 83	1634
1646	Jno. S. Reese Co., Baltimore, Md., ...	Dissolved Phosphate of Lime,	Three, ...	6.61	12.35	4.35	0.76	17.46	14 98	14 84	1646
1519	Susquehanna Fertilizer Co., Baltimore. Md.,	Soluble Bone Phosphate, ...	Two, ...	5.19	7.76	7.64	0.84	16.24	13 69	13 63	1519
1655	" " " "	Soluble Bone Phosphate, ...	Two, ...	2.95	13.39	3.56	1.02	17.97	15 34	12 75	1655
1653	Standard Fertilizer Co., Boston, Mass., ...	Dissolved Bone Phosphate, ...	Six, ...	1.98	14.06	3.13	1.45	18.64	15 74	12 40	1653
1669	Williams & Clark Fertilizer Co., New York,	Acorn Brand, Acid Phosphate,	Four, ...	3.36	12.74	3.01	2.09	17.84	14 94	14 25	1669
1671	Robert A. Wooldridge Co., Baltimore, Md.,	XXtra Acid Phosphate, ...	Two, ...	4.78	11.33	4.53	0.89	16.75	14 40	11 25	1671
1674	York Chemical Works, York, Pa., ...	Pure Dissolved S.C. Phosphate	Two, ...	7.31	13.25	1.71	1.25	16.21	14 22	13 00	1674
1675	Zell Guano Co., Baltimore, Md., ...	Dissolved Bone Phosphate, ...	Three, ...	2.98	9.54	7.03	1.33	17.90	14 78	13 75	1675
1679	" " "	Dissolved S. C. Phosphate, ...	Three, ...	3.51	13.28	3.21	0.97	17.46	15 04	12 67	1679



DR. WILLIAM S. ROLAND,
Late Member of the Board of Agriculture from York County.

TWENTY-FIRST

ANNUAL REPORT

OF THE

PENNSYLVANIA

STATE BOARD OF AGRICULTURE,

FOR THE YEAR 1897.

WM. STANLEY RAY,
STATE PRINTER OF PENNSYLVANIA,
1898.

AN ACT

TO ESTABLISH A STATE BOARD OF AGRICULTURE.

Section 1. Be it enacted, &c., That the Governor of the Commonwealth, the Secretary of Internal Affairs, the Superintendent of Public Instruction, the Auditor General, the President of the Pennsylvania State College, and one person appointed from or by each agricultural society in the State, entitled under existing laws to receive an annual bounty from the county, and three other persons appointed by the Governor, with the consent of the Senate, shall constitute the State Board of Agriculture.

Section 2. One-third of the members appointed shall retire from office on the fourth Wednesday in January each year, according to their several appointments. The vacancies thus occurring, shall be filled in the same manner as above provided, and the persons thus appointed shall hold their office for three years from the expiration of the former term. Other vacancies may be filled in the same manner, for the remainder of the vacant term.

Section 3. The Board shall meet at the Capital of the State, at least once in each year, and as much oftener as may be deemed expedient. No member of said Board shall receive compensation from the State, except for necessary personal expenses, when engaged in duties of the Board.

Section 4. They shall appoint and prescribe the duties of a secretary of the Board, who may receive a salary, not exceeding fifteen hundred dollars a year.

Section 5. They shall investigate such subjects, relating to improvements in agriculture in the State, as they may find proper, and take, hold in trust and exercise control over donations or bequests made to them for the promotion of agriculture and general interest of husbandry.

Section 6. They may prescribe forms for, and regulate returns from local agricultural societies, and furnish to the officers of each, such blanks as they deem necessary to secure uniform and reliable statistics.

Section 7. They shall annually, on or before the fourth day in January in each year, by their president or secretary, submit to the General Assembly, a detailed report of their doings, with such recommendations and suggestions as the interests of agriculture may require.

Section 8. The secretary of the Board shall, in each year, cause to be made and published, for distribution, as full an abstract of the returns from local societies, as the Board may deem useful.

Section 9. The secretary shall have a permanent office at the Capitol, under the control and supervision of the Board, which shall be supplied and maintained at the expense of the State.

This act shall take effect on the fourth Wednesday of January next ensuing.

Approved—The eighth day of May, A. D. 1876.

TWENTY-FIRST ANNUAL REPORT

OF THE

State Board of Agriculture,

FOR THE YEAR 1897.

MEMBERS EX-OFFICIO.

GENERAL D. H. HASTINGS, Governor.
GENERAL JAMES W. LATTA, Secretary of Internal Affairs.
DR. N. C. SCHAEFFER, Superintendent of Public Instruction.
HON. A. H. MYLIN, Auditor General.
DR. G. W. ATHERTON, President State College.
THOMAS J. EDGE, Secretary Board of Agriculture.

APPOINTED BY THE GOVERNOR.

Hon. Sam'l R. Downing, Goshenville, Chester county, ...Term expires 1898
Hon. Will B. Powell, Shadeland, Crawford county, ...Term expires 1899
Hon. Leonard Rhone, Centre Hall, ...Term expires 1900

ELECTED BY COUNTY AGRICULTURAL SOCIETIES.

			Term expires.
Adams,	A I. Weidner,	Arendtsville,	1900
Allegheny,	J. S. Burns,	Clinton,	1900
Armstrong,	D. W. Lawson,	Dayton,	1899
Beaver,	T. A. Clifton,	McCleary,	1899
Bedford,	D. Holderbaum,	Bedford,	1900
Berks,	G. D. Stitzel,	Reading,	1898
Blair,	F. Jaekel,	Hollidaysburg,	1898
Bradford,	L. Piolett,	Wysox,	1898
Bucks,	C. S. Balderston,	Lahaska,	1899
Butler,	W. H. H. Riddle,	Butler,	1900
Cambria,	J. J. Thomas,	Carrolltown,	1898
Cameron,	E. N. Fairchild,	Sizerville,	1900
Centre,	J. A. Woodward,	Howard,	1900
Chester,	Dr. J. P. Edge,	Downingtown,	1899

			Term expires.
Clarion,	G. T. Henery,	Piollet,	1898
Clearfield,	J. Blair Reed,	Clearfield,	1897
Clinton,	J. A. Herr,	Cedar Springs,	1899
Columbia,	H. V. White,	Bloomsburg,	1900
Crawford,	J. B. Phelps,	Conneautville,	1898
Cumberland,	C. H. Mullin,	Mount Holly Springs,	1900
Dauphin,	S. F. Barber,	Harrisburg,	1900
Delaware,	G. E. Heyburn,	Chadds' Ford,	1898
Erie,	A. L. Wales,	Corry,	1898
Fayette,	G. Hopwood,	Uniontown,	1900
Franklin,	C. B. Hege,	Marion,	1899
Fulton,	J. F. Johnston,	Webster Mills,	1898
Greene,	B. F. Herrington,	Waynesburg,	1898
Huntingdon,	G. G. Hutchison,	Warriors' Mark,	1900
Indiana,	S. M. McHenry,	Indiana,	1898
Jefferson,	Jas. McCracken, Jr.,	Frostburg,	1899
Juniata,	Matthew Rodgers,	Mexico,	1900
Lackawanna,	J. L. Stone,	Waverly,	1899
Lancaster,	Calvin Cooper,	Bird-in-Hand,	1898
Lawrence,	J. B. Johnston,	New Wilmington,	1900
Lebanon,	H. C. Snavely,	Lebanon,	1898
Lehigh,	J. P. Barnes,	Allentown,	1897
Luzerne,	W. P. Kirkendall,	Dallas,	1899
Lycoming,	A. J. Kahler,	Hughesville,	1900
McKean,	F. L. Sherburne,	East Smethport,	1900
Mercer,	T. P. Munnell,	Indian Run,	1899
Mifflin,	D. E. Notestine,	Lewistown,	1898
Monroe,	Randall Bisbing,	Minsi,	1899
Montgomery,	Jason Sexton,	Spring House,	1899
Montour,	J. K. Murray,	Pottsgrove,	1898
Northampton,	B. B. McClure,	Bath,	1900
Northumberland,	W. L. Nesbit,	Lewisburg,	1899
Perry,	J. E. Stephens,	Acker,	1898
Philadelphia,	Edwin Lonsdale,	Chestnut Hill,	1898
Potter,	W. A. Gardner,	Andrew's Settlement,	1900
Schuylkill,	W. H. Stout,	Pine Grove,	1900
Snyder,	J. F. Boyer,	Mt. Pleasant Mills,	1900
Somerset,	N. B. Critchfield,	Jenner's X Roads,	1898
Sullivan,	J. W. Rogers,	Forksville,	1897
Susquehanna,	R. S. Searle,	Montrose,	1898
Tioga,	F. E. Field,	Balsam,	1899
Union,	J. W. Shaffer,	Lewisburg,	1899
Venango,	Porter Phipps,	Kennerdell,	1898
Warren,	R. J. Weld,	Sugar Grove,	1898
Washington,	J. McDowell,	Washington,	1899
Wayne,	W. C. Norton,	Aldenville,	1898
Westmoreland,	M. N. Clark,	Claridge,	1898
Wyoming,	D. L. Herman,	Eatonville,	1898
York,	*W. S. Roland,	York,	1898

*Died January 23rd, 1897.

OFFICIAL LIST.

PRESIDENT.

Hon. D. H. Hastings, Governor.

VICE-PRESIDENTS.

W. A. Gardner, A. J. Kahler, J. McDowell.

EXECUTIVE COMMITTEE.

Hon. D. H. Hastings, C. Cooper. G. D. Stitzel,
W. H. H. Riddle, J. B. Johnston, J. Sexton,
M. N. Clark, J. A. Herr, T. J. Edge, Secretary.

ADVISORY COMMITTEE.

C. Cooper, W. H. H. Riddle, J. Sexton,
T. J. Edge, Secretary.

SECRETARY.

Thos. J. Edge, Harrisburg.

BOTANIST.

Thos. Meehan, Germantown.

POMOLOGIST.

Cyrus T. Fox, Reading.

CHEMIST.

Dr. Wm. Frear, State College.

VETERINARY SURGEON.

Dr. F. Bridge, Philadelphia.

SANITARIAN.

Dr. G. G. Groff, Lewisburg.

MICROSCOPISTS AND HYGIENISTS.

Dr. H. Leffman, Philadelphia, Prof. C. B. Cochran, West Chester

ENTOMOLOGISTS.

Prof. R. C. Schiedt, Lancaster, Dr. H. Skinner, Philadelphia.

ORNITHOLOGIST.

Dr. B. H. Warren, West Chester.

METEOROLOGISTS.

E. R. Demain, Harrisburg, J. L. Heacock, Quakertown

MINERALOGIST.

Prof. Joseph Willcox, Philadelphia.

APIARIST.

Dr. G. G. Groff, Lewisburg.

GEOLOGIST.

Prof. J. P. Lesley, Philadelphia.

STANDING COMMITTEES 1897.

LEGISLATION.

J. J. Thomas,	J. A. Herr,	G. E. Heyburn,
J. Sexton,	L. Piollet,	A. G. Seyfert,
W. L. Nesbit,	J. B. Phelps.	

CEREALS.

B. B. McClure, Chairman,	C. Eves,	H. C. Snavely,
J. J. Thomas,	M. Rodgers,	E. Lonsdale.
J. Sexton.		

ROADS AND ROAD LAWS.

S. R. Downing, Chairman,	C. Cooper,	J. P. Barnes,
Geo. Hopwood,	J. A. Herr,	A. L. Wales,
B. B. McClure,	J. A. Woodward,	J. Blair Read.

FRUIT AND FRUIT TREES.

C. Cooper, Chairman,	H. C. Snavely,	W. H. Moon,
C. T. Fox,	J. A. Herr,	Thomas Rakestraw,
W. H. Stout,	G. Hiester,	G. Hopwood,
S. M. McHenry,	J. E. Jamison,	W. H. McCullough.

ENSILAGE AND FODDER CROPS.

J. Sexton, Chairman,	S. R. Downing,	L. Piolett.
J. B. Phelps,	J. McCracken,	N. F. Underwood,
A. L. Wales,	J. A. Herr,	J. I. Carter.

POULTRY.

W. H. H. Riddle, Ch'rman,	J. McCracken,	Porter Phipps,
J. A. Gundy,	F. Jaekel,	W. H. H. Riddle,
B. F. Herrington,	J. A. Herr,	Oliver D. Schock.

FERTILIZERS.

W. L. Nesbit, Chairman,	Jason Sexton,	J. A. Herr,
W. H. Stout,	J. K. Murray,	C. Cooper,
S. R. Downing,	Geo. Hopwood.	

DAIRY AND DAIRY PRODUCTS.

A. L. Wales, Chairman,	Jason Sexton,	L. Piolett,
P. D. Rexford.		

WOOL AND TEXTILE FIBERS.

John McDowell, Ch'rman,	John G. Clark,	Isaiah Jones,
Theodore Justice.		

DR. WILLIAM S. ROLAND.
Born November 16th, 1814.
Died January 23d, 1897.

Dr. William S. Roland, late member of the State Board of Agriculture from York county, was born at New Holland, Lancaster county, Pennsylvania; he attended the public schools of the district until he was twelve years old and was then sent to Lititz Academy, where he remained one year. In January, 1830, he entered the Latin and Grammar School at Carlisle, Penna., and remained there two years.

In the Fall of 1831 he commenced the study of medicine in the office of Dr. John L. Atlee, of Lancaster, and also attended lectures at the medical department of the University of Pennsylvania. In 1835 he located, for the practice of medicine, at Carlisle, where, April 28, 1840, he married Mary Forney.

In 1862 he was appointed drafting commissioner in the service of the United States, and a short time later was appointed surgeon for the enrolling board of the counties of York, Cumberland and Perry, and served in this office until the close of the war, and was honorably relieved from duty in June, 1865. He was also United State examining surgeon, and held the office until 1868.

In 1851, he, with others, organized the York County Agricultural Society, and served as one of its officers until the time of his death, when he was its president.

He was one of the original members of the Pennsylvania State Board of Agriculture, who, answering to the call of Governor Hartranft, met at Harrisburg, February 1, 1877, and adopted the by-laws and rules under which the Board so successfully worked for eighteen years. He served the Board in numerous capacities, and was always ready for his full share of any labor devolving upon its members; he was especially useful to the State and to the Board as chairman of its committee on forestry, and also served for a number of years as a member of its executive committee, and on numerous less important committees.

MINUTES OF THE ANNUAL MEETING.

HELD AT HARRISBURG, PENNA., JANUARY 27 AND 28, 1897.

Wednesday Morning, January 27, 1897.

Board called to order at 10 A. M. by Vice President Piollet in the chair.

On motion of Mr. Cooper, of Lancaster, the Chair named a committee of three to notify the Governor that the Board was in session, and to escort him to the meeting.

The Secretary stated that the membership of the counties of Adams, Allegheny, Bedford, Butler, Cameron, Centre, Clearfield, Columbia, Cumberland, Dauphin, Fayette, Huntingdon, Juniata, Lawrence, Lehigh, Lycoming, McKean, Northampton, Potter, Schuylkill, Snyder and Sullivan had expired by limitation, and that, therefore, these counties would not be called.

Present: Governor D. H. Hastings and Messrs. Downing of Chester; Stitzel, of Berks; Piollet, of Bradford; Balderston, of Bucks; Herr, of Clinton; Phelps, of Crawford; Herrington, of Greene; Hutchison, of Huntingdon; Snavely, of Lebanon; Cooper, of Lancaster: Sexton, of Montgomery; Murray, of Montour; Nesbit, of Northumberland; Stephens, of Perry; McDowell, of Washington; Norton, of Wayne, and Secretary.

The Chair named Messrs. Herr, Herrington and Murray a committee to receive and report upon the credentials of members-elect and delegates.

Major Levi Wells, Dairy and Food Commissioner, read a report upon the enforcement of the law relating to the manufacture and sale of cider vinegar.

Prof. John Hamilton read the minutes of the previous meeting. which were approved.

On behalf of the standing committee on fruits and fruit culture. Mr. Cooper, chairman, made a verbal report.

The Secretary announced the death of Dr. William S. Roland, late member from York, and the Chair named Messrs. Stitzel, Cooper and Phelps a committee to prepare and report resolutions relative to the feeling of the Board in relation to Dr. Roland's death.

Governor Hastings, upon the part of Mrs. Hastings and himself, invited the members of the Board, and others present, to a reception at the Executive Mansion at the close of the evening session.

The Secretary announced the death of D. T. Huckell, late member from Sullivan, and the Chair named Messrs. J. W. Rogers, Fague and Herr a committee to prepare and present suitable resolutions.

Mr. Herr, on behalf of the committee on credentials, reported that the following had presented proper credentials showing their election to represent their respective organizations for the ensuing three years: A. J. Kahler, of Lycoming; H. L. Sherburne, of McKean; A. I. Weidner, of Adams; W. A. Gardner, of Potter; E. N. Fairchild, of Cameron; B. B. McClure, of Northampton; G. Hopwood, of Fayette; D. Holderbaum, of Bedford; J. W. Rogers, of Sullivan; G. G. Hutchison, of Huntingdon; W. H. H. Riddle, of Butler; W. H. Stout, of Schuylkill; M. Rodgers, of Juniata; J. A. Woodward, of Centre; C. H. Mullin, of Cumberland; J. L. Stone, of Lackawanna; J. F. Boyer, of Snyder; H. V. White, of Columbia; S. F. Barber, of Dauphin; R. J. Weld, of Warren; G. T. Henery, of Clarion, and J. B. Johnston, of Lawrence.

The committee reported that the following delegates were present with proper credentials:

Mt. Gretna Agricultural and Mechanical Exposition, Dr. S. P. Heilman; Clarion County Agricultural Society, George Okers; Tunkhannock Grange, P. of H., No. 209, H. P. Loomis; Octoraro Farmers' Club, H. Rakestraw, and Edwin Brinton; Big Cove Agricultural Society, A. W. Johnston, Jr., and J. W. Kendall; State Horticultural Association, C. T. Fox, G. Hiester, W. P. Brinton and J. E. Jamison; Lancaster County Agricultural Society, E. S. Hoover; Brandywine Grange, P. of H., No. 60, E. Walter; Berks County Agricultural Society, J. McGowan, M. N. Ritter and C. T. Fox.

On motion of Mr. Cooper, the Board proceeded to an election of officers for 1897.

Messrs. Gardner, Kahler and McDowell were nominated as vice presidents, and the Secretary directed to cast the ballot of the Board for them.

Messrs. Riddle, Clark, Cooper, Johnston (of Lawrence), Herr, Stitzel and Sexton were nominated as members of the executive committee, and the Secretary directed to cast the ballots of the Board for them.

Thomas J. Edge was nominated as Secretary, and Mr. Hutchison, of Huntingdon, directed to cast the ballot of the Board for him.

The Executive Committee reported that they had nominated Messrs. Cooper, Riddle and Sexton as members of the Advisory Committee, and that they had continued the honorary officers of the preceding year.

They also reported that they were united in reporting the same standing committees and the same chairman of the committees as in the preceding year. They also reported that they had named Messrs. Thomas, Sexton, Nesbit, Herr, Piollet, Phelps, Heyburn and Seyfert as members of the Committee on Legislation.

On motion, adjourned.

Wednesday Afternoon, January 27, 1897.

Board called to order at 2 P. M. by Governor D. H. Hastings in the Chair.

Present: Governor Hastings and Messrs. Downing, Weidner, Lawson, Holderbaum, Stitzel, Piollet, Balderston, Riddle, Thomas, Fairchild, Dr. Edge, Henery, Herr, White, Phelps, Mullin, Barber, Hopwood, Herrington, Hutchison, Cooper, Johnston (of Lawrence), Snaveley, Kahler, Sherburne, Notestein, Sexton, McClure, Nesbit, Stephens, Gardner, Stout, Critchfield, Rodgers, McDowell, Norton, Clark and Secretary.

Mr. Downing offered a resolution providing for a meeting of the Board in October, which was adopted, and Mr. Fairchild invited the Board to meet at Emporium, which was unanimously agreed to.

Mr. Underwood, of Wayne, read an essay on "Practical Methods of Fighting Weeds."

Dr. J. T. Rothrock called the attention of the Board to the spread of the blue thistle along the lines of our principal railways.

Dr. J. P. Edge, of Chester, read an essay on "Good Citizenship through Farmers' Institutes."

Mr. Rogers, on behalf of the committee on the death of D. T. Huckell, reported the following resolutions, which were unanimously adopted:

"Whereas, This Board has learned with sorrow of the sad and accidental death of D. T. Huckell, late member from Sullivan county; therefore,

Resolved, That we hereby express our deep sorrow at his demise and recognize in his death the loss of a valued and interested member, and a dignified and earnest Christian gentleman, noted for his integrity of purpose and purity of character.

Resolved, That a copy of these resolutions be spread upon the minutes of the Board, and a copy sent to the family of the deceased.

(Signed.)

J. W. ROGERS,
J. A. HERR,
ABNER FAGUE."

On behalf of the Committee on Cereal Crops, B. B. McClure made a verbal report.

Dr. J. T. Rothrock read an essay upon the "Washing of Soils."

The Committee on Legislation, to whom was referred the question of the future of the Board, reported that they had been unable to agree, and referred the question back to the members for discussion and decision.

On motion, the Secretary was requested to call the roll in order to give each membér an opporunity to express his views, as his name was called.

Messrs. Nesbit, McClure, Lawson, Balderston, Piollet, Riddle, Thomas, Fairchild, Dr. Edge, Henery, Phelps, Herr, Hopwood, Herrington, Cooper, Johnson (of Lawrence), Kahler, Sherburne, Sexton, Murray and Stephens expressed their opinion as to the future of the Board, when, on motion of Mr. Nesbit, the subject was continued to the evening session.

On motion, adjourned.

Wednesday Evening, January 27, 1897.

Board called to order at 7.30 P. M. by Governor D. H. Hastings in the chair.

The question of the future of the Board was again taken up, and Messrs. Gardner, Stout, Rogers, Nichols, McDowell, Norton, Clark and the Secretary stated their views upon the question.

Dr. J. P. Edge, of Chester, offered the following:

"Resolved, That the Committee on Legislation be instructed to secure, if practicable, practical amendments to the act establishing the Board, providing in effect that the members shall hereafter be chosen in the following manner:

When the term of any member of the Board shall be about to terminate, it shall be the duty of the local institutes to be held in the said county to elect or appoint a committee of judicious persons, and the several committees so chosen shall meet at some convenient place and time, and the said committees, or a majority of them, shall choose or elect and commission a person to be a member of the Board of Agriculture for three years or such part thereof as may appear.

Such person or member so chosen shall be the local manager of institutes in the said county, with power to choose his associates,

and to carry out the details of institute work under the general direction of the Department of Agriculture."

After a partial discussion of the resolution, Mr. McDowell, of Washington, offered the following amendment:

"Resolved, That the members of the Board of Agriculture shall be elected in accordance with the provisions of the act of 1876 heretofore passed for that purpose."

After further discussion, the amendment was adopted and the original resolution rejected.

The President then called for remarks from those not members of the Board, when Messrs. Hamilton, Phillips, Fague, Landis, Rice and Edminston, responded.

Prof. Hamilton then addressed the Board upon the subject of "Farmers' Institutes."

On motion, adjourned.

Thursday Morning, January 28, 1897.

Board called to order at 9 A. M. by Vice President Gardner in the chair.

Professor Hamilton read an essay on "The Township High School," the subject matter of which was discussed by Messrs. Piollet, Stitzel, Dr. Edge, Kendall and others.

Mr. Stitzel, on behalf of the Committee on Resolutions, relating to the death of Dr. William S. Roland, reported the following, which were unanimously adopted:

"Harrisburg, Pa., January 28, 1897.

At the annual meeting of the State Board of Agriculture, the Secretary announced the death of Dr. William S. Roland, member from York, who died on January 23d, in the 83d year of his age.

The committee beg leave to offer the following:

Dr. Roland was the last consecutive surviving member of the original number of thirteen composing the Board of Agriculture.

Dr. Roland, during his able physical condition, was an earnest and active member of this Board; he was zealous in leaving nothing undone by which he could promote the interests of agriculture. His genial presence and earnestness always commanded the greatest attention of the members; therefore,

Resolved, That we hereby extend to the members of his family and personal friends our most sincere sympathy and condolence in the death of their late associate, and that the vacant chair in this Board will be a constant reminder of our loss in his demise.

Resolved, That a copy of these resolutions be sent to his bereaved family, and recorded on the minutes of the Board of Agriculture."

Dr. J. T. Rothrock, Commissioner of Forestry, called the attention of the Board to the official records showing the steady diminution of the water supply of the Schuylkill river at Philadelphia.

Mr. Downing, of Chester, read an essay on "The Primer of Agriculture," which called out discussion from Messrs. McDowell, Cooper, Stitzel, Hoover, Johnston and Secretary.

Mr. Herr offered the following resolution, which was adopted:

"Resolved, That the Committee on Legislation be instructed to ask of the Legislature the sum of $2,000 for the payment of the expenses of the members of the Board in attendance at the meetings of the Board, and a sufficient amount to reimburse the Board for their personal expenses during the past two years."

Mr. Herr offered a resolution calling for a meeting of the Board, at the call of the Advisory Committee, in June, which, after discussion, was rejected.

After remarks by Vice President Gardner, in the chair, adjourned to meet at the call of the Advisory Committee.

EXTRACTS FROM THE REPORT OF THE SECRETARY.

MEMBERSHIP.

During the legislative session of 1897, the following bill affecting the membership of the Board, was introduced:

"To amend an act entitled 'An act to establish a Department of Agriculture and to define its duties, and to provide for its proper administration,' approved March thirteenth, one thousand eight hundred and ninety-five, providing for the appointment of local managers of farmers' institutes in the several counties of this Commonwealth, and further defining the duties of the superintendent of institutes."

"Section 1. Be it enacted, &c., That section five of said act, which reads as follows:

"That it shall be the duty of the superintendent of institutes to arrange them in such manner as to time and place of holding the same as to secure the greatest economy and efficiency of service, and to this end he shall, in each county where such institutes are to be held, confer and advise with the local member of the State Board of Agriculture, together with representatives duly elected by each county agricultural, horticultural or other like organizations with reference to the appointment of speakers and other local arrangements," shall be amended so as to read:

"That it shall be the duty of the Superintendent of Institutes to arrange them in such a manner as to number, times and places of holding the same, as to best accommodate the several localities in which they are to be held, while at the same time having a due regard to a reasonable economy. The local manager of the farmers' institutes shall be elected as follows: Each and every county agricultural, horticultural and other like organization having been in existence at least one year, and comprising an active membership of at least twenty persons, and having a constitution and by-laws governing the same, may elect one delegate who shall represent said organization in a convention of delegates, which shall be held in the court

house of their respective counties of the State, on the first Monday in June, one thousand eight hundred and ninety-seven, and every three years thereafter, and this convention shall organize by electing a president and secretary, then proceed to elect a person who shall be a practical farmer of said county to be the local manager of farmers' institutes. Said manager of institutes when elected shall assist the Deputy Secretary of Agriculture in arranging the time, place, programme and advertising for each institute. In case any county fails to elect a local manager of farmers' institutes, it shall be the duty of the Deputy Secretary of Agriculture to appoint a person, and such elected or appointed person shall also be a member of the State Board of Agriculture after the present occupant's term shall have expired. The amount of money appropriated for the conducting of farmers' institutes shall be distributed throughout the different counties of the State pro rata, according to the number of farms in each county. Not less than one-third of said appropriation shall go to the local manager of institutes, to be paid to him by the Secretary of Agriculture, the same to be applied to the payment of the necessary local expenses incurred in holding farmers' institutes in the county he represents, and to be accounted for to the Secretary of Agriculture by itemized statements duly certified by said local manager and approved by the Secretary of Agriculture, and the remainder shall be used by the Department of Agriculture in furnishing expert and scientific lecturers upon practical farming, and such other topics as relate directly to the agricultural interests of the Commonwealth, All acts or parts of acts inconsistent herewith be and the same are hereby repealed."

This act received the sanction of a majority of the General Assembly, but was vetoed by the Governor, for the following reasons:

"The first section of the act of May 8, 1876, provides that the Governor of the Commonwealth, Secretary of Internal Affairs, Superintendent of Public Instruction, the Auditor General, the President of the Pennsylvania State College, and one person appointed from and by each agricultural society of the State, entitled by existing laws to receive an annual bounty from the county, and three other persons appointed by the Governor, with the consent of the Senate, shall constitute the State Board of Agriculture. The bill in question repeals this method of making up the State Board of Agriculture and provides a new plan for their selection, but there is no notice in the title of the bill of this proposed change. This in itself is fatal to the measure.

The amendment provides that the local manager of the farmers' institutes, who is to take the place of the retiring member of the State Board of Agriculture, shall be elected by county agricultural, horticultural and other like organizations which have been in existence at least one year previous to the passage of this act and com-

prising a membership of at least twenty persons, and having a constitution and by-laws, each one of which may elect one delegate, who shall represent said organizations in a convention of delegates, which shall be held in the court house of each county of the State on the first Monday in June, one thousand eight hundred and ninety-seven, and every three years thereafter. The date fixed for the first convention of delegates is past, being set for the first Monday of June, 1897. No other convention could be held under the act before the first Monday of June in the year 1900.

If the purpose of the framers of the bill was to have it go into immediate effect, this has been defeated by their neglect to fix the date of the first meeting at a time subsequent to the passage of the act. Moreover, there is nothing in the bill to define what shall constitute a county organization, thus leaving the door open for serious misunderstandings among local authorities in the same county, that would necessarily be difficult and often impossible to settle.

The second provision in the bill proposes to distribute the money appropriated for institute purposes by an arbitrary rule, awarding not less than one-third to the local managers, and appropriating it according to the number of farms in each county. If one-third of the appropriation now granted by the Legislature for institute purposes would be so appropriated, it would be so entirely unfair to the small counties of the State as to prevent their receiving that benefit from institute instruction in agriculture to which they are justly entitled by reason of their location and necessities. For instance, Cameron county would receive but $6.67, and Forest county $9.67, and other small counties in like proportion.

The amendments proposed, in my judgment, are unnecessary. The law of 1895, establishing the Department of Agriculture, providing for the institute work, makes it the duty of the director of institutes to confer with the various agricultural organizations, and allows him all discretion in the details as is essential to its development and success. This bill would unduly limit his action, and embarrass the Department in such a way as to be extremely detrimental to its efficiency."

At the annual meeting above alluded to, after each member had been called by name and had given his views as to the future of the Board of Agriculture and numerous plans for a change in the basis of its membership had been suggested, Mr. McDowell, of Washington, offered the following resolution, which was adopted:

"Resolved, That the members of the State Board of Agriculture shall be elected in accordance with the provisions of the act of 1876, heretofore passed for that purpose."

There has, therefore, been no change in the basis of membership.

and no alteration in the plan of electing or appointing members, the county agricultural society having the sole right to send representatives with powers as members of the Board.

APPROPRIATIONS.

Previous to the year commencing June 1, 1895, the Board of Agriculture, in addition to other appropriations, had been receiving the amount of $2,000 per year for the actual and necessary expenses of its members. For the years commencing June 1, 1895, and 1896, the Legislature made no appropriation at all; the members held their annual meetings, and during one year held their usual autumn meeting, paying their own expenses.

At the annual meeting held January 27 and 28, 1897, the following resolution, offered by Mr. Herr, of Clinton, was adopted:

"Resolved, That the Committee on Legislation be instructed to ask the Legislature for the sum of $2,000 for the payment of the expenses of the members of the Board in attendance at the meetings of the Board, and a sufficient appropriation to reimburse the Board for their expenses during the past two years."

Owing to the illness of the Secretary, he was not able to assist the Committee on Legislation in their work, but no bill for the expenses of the members of the Board was approved by the Appropriation committees of either branch of the Legislature.

The Deputy Secretary of Agriculture, acting as Secretary, applied to the proper committees of the Legislature for an appropriation for the expenses of the members of the Board for the term of two years commencing June 1, 1895, but his request failed to receive the endorsement of the committee, and no bill containing such an appropriation appears to have reached either branch of the Legislature from the proper committees.

Finding that no results had followed the previous request, the Deputy Secretary of Agriculture appeared before the House Committee on Appropriations, and offered the following as an item of the appropriation bill of the Department of Agriculture:

"To reimburse the members of the Pennsylvania State Board of Agriculture for expenses incurred in holding their meetings in 1896-7, the sum of one thousand dollars, or so much thereof as may be necessary, to be paid upon vouchers approved by the Secretary of Agriculture."

This amount was intended for the expenses of the members of the Board of Agriculture in attending the annual meetings of 1896 and 1897, but, at its second introduction, the bill failed to receive the sanction of the House Committee on Appropriations. The amount ($1,000) was arrived at after the members of the Board had sent in their bills for expenses during the year 1896.

AGRICULTURAL SOCIETIES.

From data obtained from the official records, it appears that there are one hundred agricultural societies in our State, of which six are upon the list as State organizations; four of these hold regular annual exhibitions of agricultural implements and live stock, and two hold regular annual meetings for the discussion of topics relating to the interests which they represent.

The six State agricultural organizations have the following history:

1. The Pennsylvania State Agricultural Society was organized by the act of March 28, 1852, and is the oldest of the number; its membership is divided into two classes, one of which obtains a life membership by the payment of fifty dollars at the time of receiving the membership, and the other obtains an annual membership by the payment of a yearly fee of two dollars; both have equal rights at all meetings and elections for officers. Until within the past few years the society has always held independent exhibitions each fall, but recently holds their exhibitions in connection with one of the county agricultural societies. By the provisions of the act of 1852, it receives an annual bounty of $2,000 from the State treasury.

2. The Pennsylvania State Dairymen's Association originated April 15, 1871, as the Crawford County Dairymen's Association; it was not organized under legislative action, but, having increased its sphere of action, assumed its present title. It also has two classes of members, one of which receives its rights by the payment of five dollars at the time of joining, and the other by an annual payment of one dollar. Its action, as is indicated by its title, is mainly confined to the dairying interest of the State, and it is to be regretted that for want of proper support, it has become practically a local organization.

3. Pennsylvania State Horticultural Association: Was originally organized as the Pennsylvania Fruit Growers' Society, but later

adopted its present title. It also has two classes of members who obtain their several rights in a manner similar to the preceding organizations. It holds annual meetings in different parts of the State for the discussion of subjects of interest to the division of agriculture which it represents.

Under the provisions of the act of May 24, 1878, the State Dairymen's Association and the Horticultural Association each received a small appropriation from the State Treasury, but by the repeal of that act, through an oversight, these appropriations were lost, and subsequent appropriations have been refused upon constitutional grounds, the objection having been sustained by two Attorneys General.

4. Grangers' Inter-State Exposition: Holds annual exhibitions of agricultural products and machinery to which all are admitted free, the expenses being paid by a charge made for space for exhibits; it has no connection with the State government, and has never asked for nor received State aid.

5. Mt. Gretna Agricultural, Mechanical and Industrial Exposition: Holds annual exhibitions similar to those of the Grangers' Inter-State Exposition; it makes no charges for general admission, but charges a fee for entrance to special exhibits.

6. Central Pennsylvania Patrons of Husbandry Exhibition: Holds annual exhibitions of agricultural implements and products; makes no charge for admission to any portion of the exhibition and holds meetings, during the exhibition, for the discussion of agricultural topics. It is entirely independent of the State, and obtains its income and support from charges for space during its exhibitions.

Pennsylvania should, and we think, would, if properly officered and organized, have three organizations somewhat similar to the State Agricultural Society, the State Horticultural Association, and the State Dairymen's Association, but, from unexplained causes, and probably for a proper want of interest, the present organizations have practically become local organizations in their support and management. It is true that under the Constitution of the State, as interpreted by several Attorneys General, they could not receive any appropriation directly from the State, but the Legislature, if convinced of the utility and proper organization of the societies, could make the necessary appropriation through the Department of Agriculture, and it could then be used for the benefit of the respective organizations.

It is my belief that three such organizations could be supported, and that the importance of their respective interests are such as would fully warrant the Legislature in granting a reasonable appropriation, but such cannot be expected until they are so organized and managed as to be in fact as well as in name, State institutions.

Of the ninety-four county or local agricultural societies, sixty-two held exhibitions during the past year, which were attended, in some few cases by such numbers as were known twenty years ago, but most failed to pay expenses on account of the slim attendance.

Various causes have been assigned for the present unsatisfactory condition, financially and generally, of the majority of this class of organizations, but there can be no refutation of the statement that they are, as a class, in an unsatisfactory condition in all respects. Of the numerous reasons assigned we can enumerate but a few:

1. That the organization of a large number of granges and alliances, which meet weekly or semi-weekly, have furnished a substitute for the annual meetings of the agricultural societies; that our farmers meet in their local organizations and have lost their desire to meet at the county seat or other central point.

2. That, in far too many cases, the societies have degenerated into mere trials of speed, and only have the exhibit of agricultural implements and stock as an adjunct or side show.

3. That farmers have, to a large extent, withdrawn from the management of their local agricultural societies, and this his passed into the hands of those who have but little real interest in agriculture.

4. That the too general admission of side shows, gambling devices and doubtful exhibitions, has driven a certain class of patrons away from the exhibition grounds and has, on the other hand, brought there an undesirable class which has still further injured the society. One of our correspondents, in alluding to this phase of the agricultural fair question, sends us the following:

"They have schemes and tricks innumerable that appear easy and simple; but in reality they are quite difficult, and in some cases impossible to perform. They have wheels and machines that are doctored to turn as the proprietor may wish them; they have cocoanutted-headed negro dodgers to arouse the brutality of the men and boys. They have tented shows which are disgusting in coarseness and vulgarity.

Among the throngs at agricultural fairs these leeches are out of place. They contribute nothing helpful or good. They do not add to the attraction of the fair. They do not bring desirable receipts.

The harm accomplished by these self-invited fakirs would doubtless surprise us, were it possible to gather and trace back to their door all the result of their work. They distract the thought, they divert the attention, they destroy the interest in the real work of the fair."

The remaining thirty-two organizations upon our list either held no fair or have failed to make any report; of these fifteen have made no attempt to hold exhibitions but instead hold regular meetings

for the discussion of agricultural and kindred topics. Of the remainder, nearly all are not in a financial condition which will enable them to hold fairs, and some of them have practically passed out of existence further than to keep up their organization for the purpose of electing members to the State Board of Agriculture.

Each agricultural society in the State which receives or can prove its right to, an annual bounty from the county treasury, is entitled to receive an annual bounty, not exceeding one hundred dollars from the county treasury; from our records it is shown that sixty-four local agricultural societies elect members of the Board of Agriculture, and the inference is that they are entitled to bounty from the county.

Of the sixty-two societies which held exhibitions this year, we find from the returns that thirty-nine are based upon stock sold at the time of organization and since, and that twenty-three are working upon what is known as the "mutual plan."

In most cases where the society is working upon the stock plan, a par value has been fixed and this was paid by the stockholders at the time the subscription was made. The interest is paid in tickets of admission instead of cash, and the condition of the society can, in many cases, be established by the liberality of the terms granted to the stockholders in the form of admission tickets. In some organizations of this kind with which I am acquainted, the stockholder of two or more shares receives a ticket which admits himself and family to the exhibition at all times and as often as he may care to use it; other organizations, more cautious, give the stockholder a ticket with a fixed number of coupons attached, each of which is good for one admission, and when all have been used, the ticket becomes valueless.

Where the former kind of ticket is used, I have known stockholders to receive one hundred per cent. upon the amount of their investment each year, and repeated cases occur in which the stockholder obtains twenty-five per cent. per year in the form of admissions. It is hardly reasonable from a business point of view to expect any organization to sustain its financial position and pay interest at such rates.

Those societies which have been organized upon what has been termed, for distinction, the "mutual plan," issue tickets of admission for a fixed amount with the distinct understanding that they will admit the holder during the exhibition and entitle him to a vote for officers during the year for which they are issued. In a majority of cases these tickets are sold at one dollar each, and carry with them privileges which vary with the liberality of the board of managers who make the rules governing the organization.

So far as observation goes, it appears that societies which have been organized upon this plan, with managers who take a business

view of the work on hand and who do not grant too many unbusiness-like privileges to their stockholders or patrons, they are in better financial condition than others which have started and carried on their exhibitions upon a stock basis.

We believe that the true plan, in either case, is to sell coupon tickets entitling the holder to a certain number of entrances to the exhibition, and no more; the price of these tickets can be made to suit the locality in which the fair is held, and should be based upon one entrance to each half day of the fair.

From the official returns of former years, we make the following estimates of items connected with the management of the local societies which hold exhibitions:

Value of real estate owned by county societies, ...	$450,000 00
Amount of premiums at autumn fairs, ...	65,000 00
Total cost of autumn fairs, ...	100,000 00
Total amount of bounty paid from county treasuries, ..	3,250 00
Number occupying grounds owned by the society, ...	41
Number occupying leased grounds, ...	21

Observation and the experience of other states which have no more extensive agricultural interests than our own, convince me that Pennsylvania could and would support three distinctively state organizations similar to the three first upon the list alluded to, and if those which we now have were freed from debt and reorganized in a manner which will justly entitle them to be considered as State organizations, I am satisfied that the Legislature would, in some manner not at variance with the mandates of the Constitution, grant them appropriations as is done in so many other states of the Union. I can see no reason why our State should not be willing to take up a line of action which has proven so successful in many other states, but to ensure this, the persons who control the organizations must have the confidence of the people and the Legislature.

COMPARATIVE VALUATION OF FERTILIZERS.

There is probably no one item in connection with the analyses and valuation of fertilizers which more thoroughly illustrates the fall in the prices and value of some kinds of fertilizers than the figures used in establishing the "Comparative Commercial Values" of the fertilizers. This can best be shown by a comparison of the figures

used in 1877 and those used in 1897; those used in 1877 were as follows:

Soluble and reverted phosphoric acid,	10 cents.
Insoluble phosphoric acid,	4 cents.
Potash,	7 cents.
Ammonia,	17.5 cents.
Nitrogen,	20.5 cents.

The prices used in the valuations of 1897 are as follows:

Nitrogen, in ammonia salts,	13½
in nitrates,	14
in dry and fine ground fish, meat and blood, and in mixed fertilizers,	14
in cotton seed meal and castor pomace,	12
in fine bone and tankage,	10
in medium bone and tankage,	9
in coarse bone and tankage,	7
Phosphoric acid, soluble in water, in bone fertilizers,	5½
soluble in water, in rock fertilizers,	3
soluble in ammonium citrate, in bone fertilizers,	5
soluble in ammonium citrate, in rock fertilizers,	2½
insoluble in ammonium citrate, in bone fertilizers,	2
insoluble in ammonium citrate, in rock fertilizers,	1½
Phosphoric acid in fine bone, tankage and fish,	3½
in medium bone and tankage,	2½
in coarse bone and tankage,	2
in fine ground fish, cotton seed meal, castor pomace and wood ashes,	4½
Potash in high grade sulphate and in forms free from muriate (or chloride),	5
as muriate,	4½

It will be noted that, with the advancement of scientific knowledge in the manufacture and analyses of fertilizers, our chemist now makes a large number of classifications; thus in 1877 we had but one grade of bone and the same valuation was assigned, whether the article was fine or coarse; this was a manifest injustice to the manufacturer, as, the sample being exactly the same in each case, the fine bone cost him more than that coarsely ground, and it was on account of more rapid action, more valuable to the consumer. In 1877 no difference was made as to the source of the phosphoric acid, and in fact at that time there was but little difference in its

cost from different sources, that from acidulated S. C. rock costing about as much as if from home; this is not, however, the case at the present time, as South Carolina rock has fallen in price more rapidly than bone.

This may be illustrated by the following average analyses of all samples of S. C. rock analyzed in 1877, with those of recent dates; in 1877 the average sample of rock gave the following analysis:

Soluble and reverted (available) phosphoric acid, ...	12.42
Insoluble phosphoric acid, ...	3.46
Average comparative commercial value, ...	$30 15
Average selling price per ton, ...	26 50

Under the present system of valuation, with allowances in the form of cost of bagging, commissions to agents, and freight, which are not directly included in the figures of 1877, the valuation of this fertilizer would be but $13.38, and it could no doubt be purchased now at about $12.50 per ton, by the single ton, or in larger amounts for $10.00 per ton, sales of even better articles having been made as low as $9.75 per ton net cash at the railroad station.

In 1896 the average selling price of 64 samples of S. C. rock was $16.98 per ton; since that date there has been another fall in prices until it would seem that any further decrease would involve manufacturers in great losses.

In 1880 the average sample of acidulated South Carolina rock gave the following analysis, valuation and selling price:

Soluble phosphoric acid, ...	7.73
Reverted phosphoric acid, ...	3.88
Insoluble phosphoric acid, ...	4.67
Comparative commercial value, ...	$27 20
Average selling price, ...	24 10

This decrease in price and value does not so closely follow complete fertilizers, for, of the analyses made in 1877, the average selling price was $29.70 with an average valuation of $33.33. During 1896 the average selling price of 334 samples was $29.54 and the average valuation $29.58.

In 1877 the average of all samples of ground bone tested gave the following analysis:

Insoluble phosphoric acid, ...	21.52
Nitrogen, ...	5.06
Average commercial value, ...	$40 14
Average selling price, ...	35 80

In 1896 the average selling price of 75 samples of ground bone was $29.54 and the average valuation $29.72.

The American Fertilizer states that at Loir-et-Cher in France the farmers annually have public sales at which manufacturers of fertilizers bid against each other for the supplies needed by the members of the club; this year the fertilizers were purchased by the car load at the following prices:

Fertilizer for Cereals—To contain 6½ per cent. of available phosphoric acid, 8 per cent. of potash and 5 per cent. of nitrogen, $24.90 per ton.

Fertilizer for Grass Lands—To contain 4 per cent. of available phosphoric acid, 8 per cent. of potash, and 6½ per cent. of nitrogen, $25.57.

Fertilizer for Root Crops—To contain 6½ per cent. of available phosphoric acid, 8 per cent. of potash and 6½ per cent. of nitrogen, $30.30.

Fertilizer for Grapes—To contain 6½ per cent. of available phosphoric acid, 14 per cent. of potash and 4 per cent. of nitrogen, $28.00.

At the same sale contracts were taken to furnish fertilizers at the following prices per ton:

Superphosphate, 14 to 15 available phosphoric acid, ...	$11 87
Superphosphate, 10 to 12 available phosphoric acid, ...	9 75
Kainit, 23 to 25 per cent., ...	13 32
Dissolved bone, 15 to 17 per cent., ...	14 86
Ground bone, 60 to 65 per cent. bone phosphate, ...	17 37
Sulphate of ammonia, 20 to 21 per cent., ...	43 62
Sulphate of potash, 48 to 50 per cent., ...	46 61

CROP ROTATION AND NITROGEN.

It has long been known that a large crop of clover may be taken from the soil, and it still remains richer in nitrogen than before; it has also been apparent that a rotation of corn, oats and wheat leaves the soil poorer in nitrogen notwithstanding there may have been an application of this element during the rotation, and it has been still more certainly known that continued crops of either of these grains will more rapidly exhaust nitrogen than a rotation of them, but nothing definite appears to have been learned as to the extent of this increase or decrease of nitrogen until the publication of the experiments of the Minnesota Experiment Station, as given in Bulletin No. 53, for June, 1897.

In this experiment every possible care appears to have been taken

to avoid any disturbing element and to eliminate all possible causes of variation and error, and the result may be taken as a fair exponent of the gain and loss of nitrogen in the kind of soil used for the experiment.

Careful analysis proved that at the commencement of the wheat experiment the soil contained 0.221 per cent. of nitrogen and that, taken to a depth of nine inches, it contained 5.400 pounds of nitrogen per acre. The plots were cropped four years with wheat and it was then found that plot No. 1 only showed nitrogen present to the extent of 0.93 per cent., showing a loss of 0.028 per cent. or at the rate of 171 pounds per acre. The actual amount of nitrogen removed by the wheat during the four years was 98 pounds; the difference between the amount removed by the crop and the amount actually lost from the soil was 146 pounds per year. This Dr. Snyder accounts for as follows:

"This nitrogen was lost by the oxidation of the humus, by nitrification, mechanically, by wind storms, and through the loss of nitrates by drainage. It is to be observed that for every pound of nitrogen removed in the wheat crop, there has been a loss of over five pounds from the soil."

From the results of this experiment Dr. Snyder draws the following conclusions:

"In continuous wheat raising without rotations or the use of manures, the decline in crop producing power is caused mainly by the excessive loss of nitrogen, not entirely on account of the nitrogen removed in the crop, but because of the destruction of the humus. When the nitrogen is combined with humus it is in a stable form, but as soon as the humus is destroyed the nitrogen is converted into gaseous and other forms which are readily lost. The continuous cultivation of small grains is particularly favorable to the destruction of both the humus and the nitrogen. The crop is unable to utilize all of the nitrogen that is liberated by the breaking down of the humus. This change takes place during nearly eight months of the year, while the spring wheat crop takes its nitrogen from the soil in the spring and early summer months when there is less decomposition of the humus taking place than later in the year."

From this explanation of the result it will be seen that, after the nitrogen has been liberated from the humus, if it is not very soon utilized by the plant, it becomes practically lost by leaching down or through the soil and more or less passes out with the surplus or drainage water, or out and over the soil by washing, and if, as Dr. Snyder claims, the nitrogen can only be utilized by the wheat crop during about fifty days of the year and is formed during the whole year, the fact that continuous crops of one kind of grain are exhausting is easily explained.

On plot No. 2 of the experiment a rotation of corn, oats or barley was grown continuously for four years with the result that the soil which at the commencement of the experiment contained 0.211 of nitrogen had, after four crops of each kind of grain, reduced the stock to 0.197, showing an actual loss of 340 pounds per acre. During this time the crops had removed 225 pounds of nitrogen, thus leaving 29 pounds of nitrogen per year not accounted for. In referring to this experiment Dr. Snyder writes: "Compared with the continuous wheat plot the loss of nitrogen from the corn plot has been materially less but the loss is much greater than it should be. Many farmers have observed that when wheat follows corn the yield of wheat is increased. Although the corn crop takes more nitrogen from the soil than a wheat crop, the cultivation of the corn crop favors the nitrification (production of nitrogen from humus) and results in leaving more available nitrogen in the soil. Incidentally it may be said that growing corn between wheat crops is not so hard on land as a bare summer fallow."

On plot No. 2 clover was introduced into the rotation and a great change in the effect was visible; the soil which at the beginning of the test contained 0.221 of nitrogen at the end of the four years rotation showed 0.231 per cent. The total amount of nitrogen removed was 178 pounds but during the rotation there had been a gain of 245 pounds per acre. In explaining this result Dr. Snyder writes:

"This nitrogen (the gain) it is believed has been gained largely by the clover (of which the second crop was turned under), from the free nitrogen of the air. Compared with Plot No. 1, this plot, after producing larger crops, contains much more nitrogen per acre; that is, when the rotation was followed, in which clover formed an important part, instead of a loss of nitrogen there was a gain."

In referring to that portion of the experiment in which the plot was cropped continuously with corn for four years, the crop removed 84 pounds of nitrogen per acre and 29 pounds was lost by washing, drainage and in other natural ways.

In a plot cropped continuously with oats for four years the crops removed but 64 pounds per acre and there was a loss of 150 pounds per acre from other causes. This loss is supposed to be largely due to the decomposition of the humus and the change of its nitrogen to a more volatile and soluble form in which it is much more readily removed from the soil by drainage and similar causes.

In referring, in a general manner, to the loss of nitrogen by causes other than the crops taken off the land, Dr. Snyder writes:

"There is no element of the soil that requires more careful consideration at the present time than the element, nitrogen. It is the most expensive of all the elements. When purchased in the form

of commercial fertilizers it costs from 12 to 17 cents per pound. The reason why nitrogen in the soil decreases so rapidly is because it readily breaks loose from the humus (decaying vegetable and animal matter) with which it is combined, and when separated from this humus it forms either gaseous products like ammonia, or compounds known as nitrates, which are washed out of the soil by rains, or the nitrates may be lost by the workings of the organisms which liberate the nitrogen as a gas."

SILOS AND ENSILAGE.

While ensilage as a stock feed is not making the rapid progress which its early supporters predicted for it, our correspondence clearly shows that it is gradually growing into favor, and that its converts are permanent. Early in its use several mistakes were made, the greatest of which was probably planting too thickly and cutting too green. It has now been learned that in order to make the best silage the corn should not be planted very much thicker than for ordinary field culture, and that it should not be cut very much earlier. One of the largest feeders of silage in Dauphin county, if he has not enough silage corn to fill the silos, cuts his ordinary field corn into silage, and each year is planting his silage corn thinner until it is now very little, if any thicker than his ordinary crop.

The fashion as to the shape of the silo is also slowly but surely undergoing a change; stone silos are now hardly thought of and were always too expensive; the coming silo will be one which may be built by the better class of farm hands; will be circular in shape and have more or less wood, or other good non-conductor, in its make-up. Probably the coming and perfect silo will be a steel or iron cylinder lined and sheathed with wood; experiment and experience have shown that the iron cylinder cannot be depended upon as there will be too much loss from freezing during cold weather, but it has also been shown that a lining of boards, with an air space between, will keep the silage free from freezing even during our coldest weather. A lining of five or six inches will form a sufficient non-conducting space to make the contents safe and the cylinder, painted on the outside, will last indefinitely.

The next best, and most common silo, will no doubt be the cylinder formed of light boards and studding. S. F. Barber, one of the most progressive dairymen of Dauphin county, has constructed two

large silos which appear thus far to completely fill the bill for convenience, utility and low cost. On a brick circular foundation, studding is set up in a circle and stayed so that it cannot get out of position readily; half inch boards are bent around the inside of the studding and nailed tight; a layer of tarred paper is then tacked on and then another layer of half inch boards, care being taken to break joints at the ends and also at the edges of the boards. These silos have for two years past proven very satisfactory; being balanced all round and the pressure being even, there is no tendency to spread in any direction, and the sides, even with but sufficient staying to hold them while the boards were nailed on, there have been no signs of bulging or spreading at any point.

Probably it would be an improvement to have six inch steel or iron hoops every five or six feet up the sides, but thus far there has been no indication that any such stays are necessary, and as they would add very materially to the cost, Mr. Barber has no disposition to adopt them, but if found necessary they can be added at any time with but little expense beyond their first cost.

Many of the extravagant claims which were formerly made for ensilage have been abandoned, and it is now clearly proven that it is not only a cheap and economical way of harvesting corn which is to be fed to stock but that, as compared with the ordinary method, it saves a larger per centage of the crop and saves the miller's toll for grinding the grain. As corn and corn fodder are usually housed, silage gives us a great saving which probably of itself pays all the expenses of the silo, and we have in addition the great convenience of feeding out during the winter.

It is to be noted that those who have used ensilage for several years are slowly but surely lengthening the season of feeding it, and are each year increasing the capacity of their silos so as to keep their cows in the yards for a longer period in the spring and fall, and some of those who seem to best understand the economy of feeding are looking forward to a time when ensilage, grain and dry provender will enable them to keep their stock in the yards nearly or quite all the time, and thus given them an opportunity of greatly increasing their stock without any increase in the acreage of the farm, it being shown conclusively that by the use of ensilage more animals may be kept from the product of a given area.

COST OF FENCING.

The correspondence of the past year indicates that the cost of fencing materials and the cost of fencing is attracting more than usual attention, and a circular letter sent out to some of our correspondents shows that there is a wide difference of opinion among practical men as to the aetual cost of fencing. This variation seems to be more in relation to the cost of material in the rough than in its after preparation or in the erection of the fence.

Ten years ago, as Secretary of the Board of Agriculture, I collected a large amount of statistics bearing upon this question; numbers of circulars were sent to correspondents and the replies carefully condensed and tabulated. In this investigation the following line of examination was pursued:

Post and Rail Fence.—Cost of chestnut rails, in the rough, per hundred; cost of pointing rails, per hundred; cost of chestnut posts, in the rough, per hundred; cost of locust posts, in the rough, per hundred; cost of hewing and mortising posts, per hundred; cost of four rail fence, per panel; cost of five rail fence, per panel.

Worm Fence.—Cost of rails, per hundred; cost of fence of five rails and rider, per panel.

Board Fence.—Cost of sixteen-foot hemlock fence boards, per thousand feet; cost of sixteen-foot pine fence boards, per thousand feet; cost of chestnut posts for board fence, per hundred; cost of locust posts for board fence, per hundred; cost of four rail board fence per rod; cost of five rail board fence per rod.

Wire Fence.—Cost of posts for wire fence, per hundred; cost of putting up four-wire fence, per rod; cost of putting up five-wire fence, per rod.

From the answers received to the circulars the average of each item for the whole State was obtained and was as follows:

Cost of chestnut rails, per hundred, in the rough, ...	$7 00
Cost of pointing chestnut rails, per hundred, ...	1 05
Cost of chestnut posts, in the rough, per hundred, ...	11 34
Cost of locust posts, in the rough, per hundred, ...	23 87
Cost of hewing and mortising posts, per hundred, ...	8 88
Total cost of four rail fence, erected, per panel, ...	63
Total cost of five rail fence, erected, per panel, ...	69
Cost of rails for worm fence, per hundred, ...	4 72
Cost of worm fence, erected, per panel, ...	42
Cost of hemlock boards, sixteen feet long, per 1,000 feet,	12 70
Cost of pine boards, sixteen feet long, per 1,000 feet,..	18 25

Cost of chestnut posts for board fence, per hundred,..	9 45
Cost of locust posts, for board fence, per hundred, ...	18 00
Cost of four rail board fence, erected, per rod, ...	79
Cost of five rail board fence, erected, per rod, ...	90
Cost of posts for wire fence, per hundred, ...	9 52
Cost of putting up wire fence, per rod, ...	14
Total cost of wire fence, erected, per rod, ...	60

The estimates representing the cost of locust posts in the rough varied very much, and from the correspondence which accompanied the estimates it was evident that much of this variation was due to a difference in opinion as to the proper size for posts.

For chestnut posts in the rough the price varies from $22.00 in Philadelphia county to but $4.50 in Sullivan. The cost of chestnut rails suitable for post and rail fences varied from $18.00 per hundred in Philadelphia to but $3.00 in Huntingdon, Greene and Fulton.

The estimated cost of hewing and mortising posts varied from $12.75 per hundred in Juniata to but $4.00 in Bedford, but the indications are that the latter price cannot include the board and wages of a good hand.

The estimate for locust posts, suitable for mortising, in the rough, varies from $40.00 per hundred in Adams to $15.50 in Columbia. The estimated cost of a four rail fence, including all items until the fence is finished, varies from $1.20 per panel in Philadelphia county to but 35 cents in Fayette. The estimated cost of a worm fence, five rail, and a rider, varies from 75 cents in Philadelphia county, to but 26 cents in Greene.

The estimated cost of a four rail board fence with chestnut rails, erected, varies from $1.45 in Allegheny to 45 cents in Westmoreland. The cost of a wire fence of five wires varies from 30 cents per rod in Cambria to but 18 cents in Bradford and Dauphin.

Mr. Reeder, who represented Bucks county in the Board of Agriculture, estimated the cost, in his locality, of a four rail board fence as follows:

Forty feet of hemlock fence boards, at $20 per hundred,	$0 80
Two chestnut posts, at $12.00 per hundred, ...	24
Nails, ...	01
Labor, ...	05
Total cost of fence per rod, ...	$1 10

VARIATIONS IN MILK.

Notwithstanding all that has been said at our farmers' institutes, all that has been published in our agricultural journals and all that has been published in book and pamphlet form, there are many dairymen who fail to make the proper distinction between the milk of the different cows of their dairy, and who are keeping a large number of animals which do not pay their board. To such we would offer the following suggestions, showing the difference in value between the different grades of milk, and state that, within certain limits, the higher grades are quite easily attainable:

In the following statement the butter in each case is supposed to sell for 25 cents per pound, and the amounts are based upon this rate; the only variation is supposed to be in the percentage of butter fat contained in the milk:

100 pounds of milk, 3.0 per cent. fat, 3.27 lbs. of butter,..	$0 82
100 pounds of milk, 3.6 per cent. fat, 3.98 lbs. of butter,..	1 00
100 pounds of milk, 4.0 per cent. fat, 4.44 lbs. of butter,..	1 11
100 pounds of milk, 4.6 per cent. fat, 5.17 lbs of butter,..	1 29
100 pounds of milk, 5.0 per cent. fat, 5.66 lbs of butter,..	1 42
100 pounds of milk, 6.0 per cent. fat, 6.88 lbs. of butter,..	1 72

Or, putting the same logic in another form; suppose the cow in each case to give 20 pounds of milk per day for 275 days or 5,500 per year, and let us compare the first and the third and sixth cows and see how the balance sheet will stand.

The first cow, giving 3 per cent. milk, will make 179.85 pounds of butter, which at 25 cents is worth $44.96, while the third cow, with 4 per cent. milk, will, under like circumstances, make 244.20 pounds of butter, which at the same price is worth $61.05, and in all probability there is little or no difference in the cost of keeping the two cows. To make the comparison still stronger and the difference still greater, let us compare the first and sixth cow on a similar basis, and we will find that while the butter from the first is worth $44.96 in the market, that made by the sixth will bring $70.05, or that, in other words, the butter from the sixth cow is worth $25.09 more than that from the first.

This brings us to the question of the payment for milk upon the basis of butter fat, and certainly no one can reasonably object to such a plan by which each patron secures the value of the milk which he brings, for it is manifestly unfair to expect a man who brings 4 per cent. milk to receive the same price per hundred pounds

as does the one bringing a 3 per cent. article. It is, then, but fair that each one should be credited with the butter fat (not milk) which he delivers.

This equitable division according to butter fat delivered may readily be secured upon the following basis; let us suppose that the deliveries at the factory during a given period have been as follows:

Patron No. 1 has delivered.........	293.0 pounds of butter fat.
Patron No. 2 has delivered.........	245.0 pounds of butter fat.
Patron No. 3 has delivered.........	263.8 pounds of butter fat.
Patron No. 4 has delivered.........	316.5 pounds of butter fat.
Other patrons have delivered, ...	1,760.7 pounds of butter fat.
Total delivery, ...	2,879.0 pounds of butter fat.

Let us now suppose that this total yield sold, clear of all expenses, for $719.75 and that this amount is to be divided among those who furnished the milk. Dividing the net receipts by the number of pounds of butter fat, we find that the price obtained has been 25 cents per pound, and upon this basis we divide the money as follows:

Patron No. 1, 293.0 pounds of butter fat, ...	$73 25
Patron No. 2, 245.0 pounds of butter fat, ...	61 25
Patron No. 3, 263.8 pounds of butter fat, ...	65 85
Patron No. 4, 316.5 pounds of butter fat, ...	79 13
Other patrons, 1,760.7 pounds of butter fat, ...	440 17
Total, 2,879 pounds of butter fat, ...	$719 75

In referring to the old mode of purchasing milk, or of dividing the profits of the factory, on the basis of the weight of the milk delivered, instead of on the basis of butter fat, Prof. Voorhees, of the New Jersey Station, writes thus:

"Under these conditions (the old method of division), the production of a poorer quality of milk, less than 3.5 per cent. rather than a higher quality, 4 per cent. of fat or over, is encouraged, and the consumers of the poorer product are charged higher prices for the actual nutrients furnished than the consumers of the richer products. The investigation referred to shows that the fat contents of milk was a safe guide as to nutritive value, and hence a practical remedy for this state of affairs would be to have retail transactions in milk made the basis of composition or fat content, rather than on the basis of volume, as at present conducted."

COMPARATIVE COST AND VALUE OF ENSILAGE AND DRY FODDER.

The New Jersey Experiment Station, in Bulletin No. 122, gives the results of careful experiments made for the purpose of determining the comparative cost and feeding value of ensilage and dry corn fodder, and thus summarizes the results in a compact form:

"1. That the cost of harvesting, storing and preparing the dry matter contained in corn was greater in the form of silage than in the dried fodder.

2. That the changes that occur in the composition of the silage were not such as to decrease its feeding value in a greater degree than those which occur in the process of curing corn fodder.

3. That for milk and butter production the feeding value of the dry matter of the silage was greater than that of the dried fodder corn. The yield of milk was 12.8 per cent. greater, and the yield of fat 10.4 per cent. greater.

4. At one cent per pound for the milk produced, the value of the corn crop was nearly $10.00 per acre greater when fed in the form of silage rather than in the form of dried fodder."

The comparative cost of the two processes, per acre, is given as follows:

Silage.

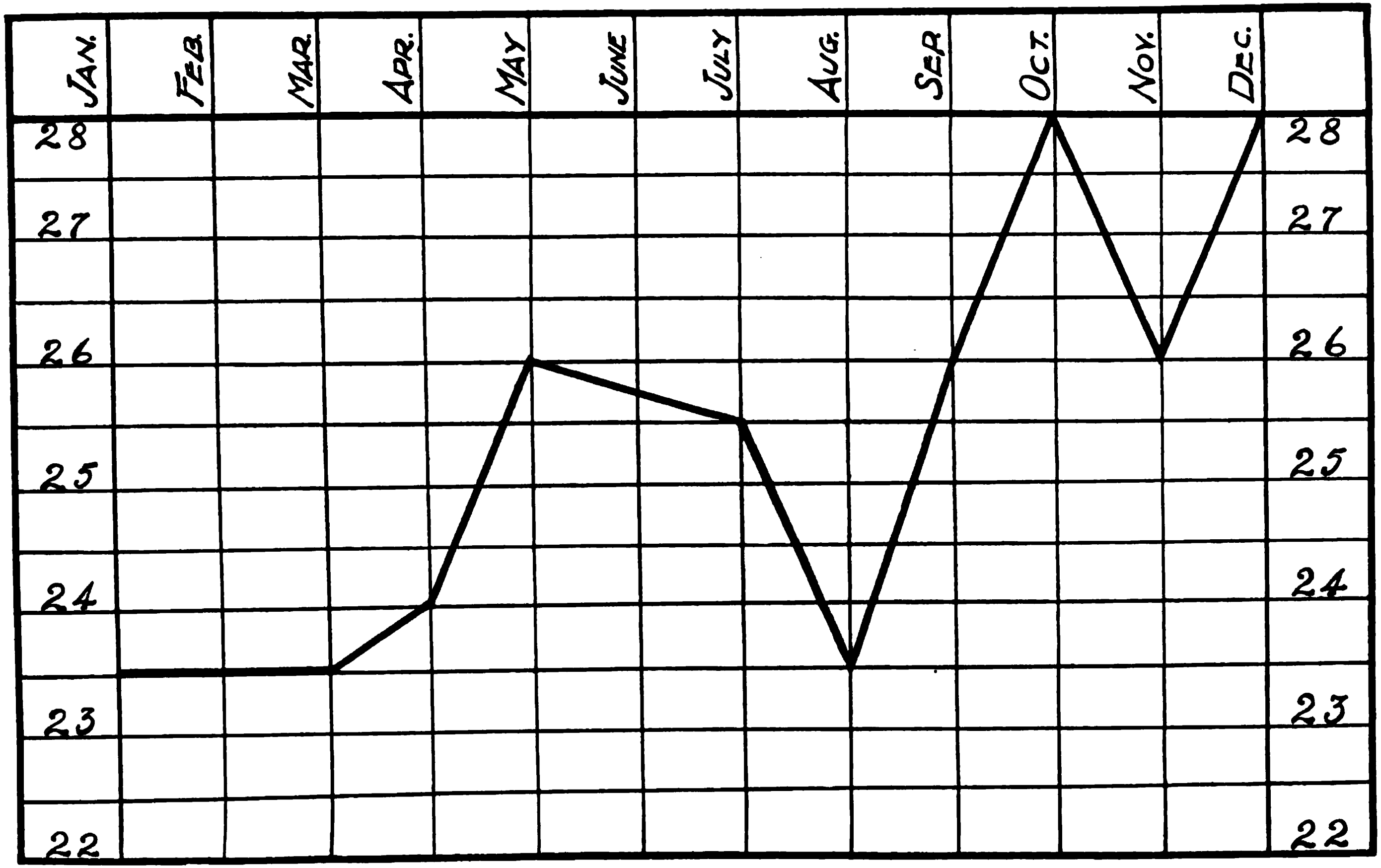
Yield, 11.25 Tons.

Cutting in field,	$0 88
Carting,	4 51
Engine, engineer and cutter,	3 30
Labor at cutter,	1 10
Labor packing in silo,	1 10
Coal for engine,	33
Total per acre,	$11 22

Fodder Corn.

Yield, 4.1 Tons.

Cutting in field,	$0 88
Shocking,	1 00
Carting and storing,	3 50



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Engine, engineer and cutter,	3 50
Labor at cutter,	1 10
Coal for engine,	33
Total per acre,	$10 31

"It will be observed that the expenses per acre of handling and preparing silage were about 9 per cent. greater than for the dried fodder. At the time the green crop was stored in the silo it contained 28.21 per cent. of "dry matter," and when the dry fodder was stored it contained 75.37 per cent. of "dry matter," thus the cost of storing and preparing the dry matter in the form of silage was $3.54 per ton, and in the form of dried fodder, $3.33 per ton, a difference on the dry matter basis of 21 cents per ton, or 6.3 per cent. in favor of the dried fodder."

In summarizing the results, the following is given:

"Applying the results in a practical way, that is, to the actual amount of corn put into the silo, namely, 135 tons, it is shown that what did cost $134.64 to store and prepare in the form of silage, would have cost in the form of dried fodder $123.72, or $10.92 less. Deducting from the amount put into the silo the 4 per cent. loss, it is found that there remained for feeding 73,120 pounds of dry matter, sufficient for one cow 6,647 days, or for 30 cows 222 days. This, or its equivalent, was practically what was done with the silage, and with an actual average yield during the period of 17 pounds per cow per day, we have a total of 112,999 pounds of milk. If, as the experiment indicated, this yield of milk was 12.8 per cent. greater than could have been produced from the same dry matter in the form of dried fodder, there is a gain of 12,822 pounds of milk, which at 1½ cents per pound, which was the price which could have been received for the milk at wholesale—the milk sold at retail—would have amounted to $192.33.

Assuming that only one cent per pound could have been secured, which is probably nearer the actual price received from November to April in districts distant from the city, the increase would have amounted to $128.22; deducting from this the $10.92 representing the greater cost of storing the silage, and we have a difference on the basis of one cent per pound of $117.30, which shows the increased value of the corn crop on twelve acres (nearly $10.00 per acre on the basis of one cent per pound) when fed in the form of silage, rather than in the form of dried fodder."

THE THEORY OF FEEDING.

In Bulletin No. 39 of the Maine Experiment Station, Prof. Bartlett gives the following compact, concise and excellent review of what is now known as to the theory of the use of feeding stuffs:

"The valuable ingredients in animal foods are ash or mineral matter, protein, and fat and a class of compounds called corbohydrates, of which starch, sugar and crude fibre are the most important examples. Although the ash or mineral matter is essential to the well being of the animal, it is abundantly supplied by most of the materials one is likely to feed, so what one most needs to consider in buying and using cattle foods are protein, fat and carbohydrates.

A sufficient supply of protein in the food is indispensable. The working animal depends upon it to replenish and repair its working machinery, the growing animal to make muscle and build up its whole system, the sheep to make wool and the milk cow to make the casein and albumen of its milk. No other substance can take its place or be manufactured into protein by the body. When more protein is fed than is needed for the growth or repair of the body, the excess performs the same functions as the fats and carbohydrates. As a rule, however, this is not an economical use to make of it. It is worth but slightly more than the carbohydrates and about six-tenths as much as fats for this purpose, and is, commonly, the most expensive ingredient for producers to buy.

The office of the other two substances, fat and carbohydrates, is two-fold. First, they serve as fuel and are oxidized or burned in the body to supply heat and force. The fat is worth about two and one-fourth times as much as the carbohydrates for that purpose. Second, they are used as material for making fat.

For convenience in stating the relation of protein to carbohydrate material the term nutritive ratio is used. By nutritive ratio is meant the relative amount of digestible fat and carbohydrates compared with the digestible protein. That is, if a food is said to have a nutritive ratio of 1 to 6, that means that for every pound of digestible protein it contains six pounds of digestible carbohydrate material. To find the nutritive ratio, the digestible fat is multiplied by two and one-fourth and the product added to the carbohydrates. This sum, divided by the number of pounds of digestible protein, gives the number of pounds of carbohydrate material to one pound of protein.

It has been ascertained, by accurate experiment, that the amount of food required to keep an animal from losing weight is not

materially different for different animals of the same size and species. All the food that they will profitably eat above that amount depends on their individual digestive and producing capacity. It is therefore evident, that a ration which would be profitable for one animal would not be for another, and no hard and fast rules can be made. For this reason the accuracy of feeding standards has been questioned by some feeders, but they certainly must be considered a vast improvement over the commonly practiced, haphazard feeding of any materials at hand. The successful and progressive feeder can, by studying his herd, learn the capacity of each animal and vary its ration from the standard to suit the individual.

The German feeding standards recommended by Wolff are the ones generally employed in this country when any standards are made use of. A so-called American standard for dairy cows, which was obtained by Woll, by means of extended correspondence with dairymen in all parts of the country and the use of averages for composition and digestibility of foods, gives a somewhat wider ration with a nutritive ratio of 1:6.9 and only 2.13 pounds digestible protein per day. This ration can hardly be said to be based on scientific data, and is probably too wide to give the best results in most cases. In fact some of our best dairymen in this State claim to derive the most profit from a ration having a nutritive ratio of about 1:4, which is much narrower than the German ration and perhaps cannot be continuously fed dairy cows with safety. Authorities quite generally agree that a thousand pound cow, of average capacity for producing milk, should have about 2.5 pounds of digestible protein per day, and it would be questionable whether a Maine farmer, who is obliged to buy commmercial fertilizers, could profitably feed any less to a cow of that size. At the present low prices of cotton seed and gluten meals one can afford to feed the maximum amount of protein for the sake of increasing the value of the manure. Both of the above feeds contain fertilizing materials enough to amount to more than their cost when valued according to the valuations given to commercial fertilizers."

REMOVING ABSORBED ODORS FROM MILK.

On this subject Prof. Russell, of the Wisconsin Station, gives us the following:

"In case the defective milk is caused by the direct absorption of

some pre-existing odor, the method of treatment as to cure or prevention should be radically different from that employed where the difficulty is of biogenic origin. These absorbed taints have their source either in the animal herself or are taken up by the milk subsequent to its withdrawal.

As with abnormal fermentations produced by living organisms, it is much easier to prevent than to overcome an imperfect condition in milk. If the difficulty is due to absorption after milking, it can easily be prevented by removing the milk from the odoriferous source. Milk houses—and every well regulated dairy should have a room or building set apart specifically for the purpose of storing the milk—should be entirely free from any objectionable odor. The room should be thoroughly ventilated so as to remove all rank odors that are apt to arise from places that are subject to much moisture.

If the defect is most pronounced at time of milking, undoubtedly it can be traced directly to the animal. It may be due either to the normal odor, popularly called animal or cowy odor, that is usually present in milk to a greater or less degree, or the difficulty may be caused by the animal eating certain weeds or plants in her feed.

The so-called animal odor is more or less constant in its appearance, independent of the character of the feed, although it varies in intensity in different animals. Just how the odor is produced is not thoroughly known, but it is probably carried by the blood to the various tissues of the body and absorbed from the circulation directly by the milk. Cabbages, turnips, rape and silage when fed to cows likewise produce a peculiar flavor in the milk. These foods contain various volatile substances that are absorbed from the alimentary canal by the blood and are subsequently eliminated through the various excretory channels, lungs, skin and kidneys. If the milk is drawn a few hours after the animal has partaken of such foods the peculiar odor will often be quite marked. To a considerable extent the intensity of this odor can be diminished by regulating the time of feeding. Where such crops are fed they should be given the animal immediately after milking, so as to give the animal the longest possible time for their elimination before the succeeding milking. The amount fed also has a considerable effect on the intensity of the odor. The animal herself likewise exerts an individual peculiarity, the taint being more pronounced under similar conditions with some cows than with others. Where such feeds are given to cows it is important that no more should be fed than will be consumed in a relatively short time. If the animal has access to such feeds in her manger for a considerable number of hours, a tainted condition in the milk is sometimes observed that would not have been present if the food had been eaten immediately.

Cows on pasture often eat weeds or plants that impart peculiar

and oftimes obnoxious flavors to the milk. The onion family, represented by the leaks, garlic and wild onions, are notorious in this regard. Cows running in the woods, especially in spring, are liable to have their milk affected from such a source. In some parts of the United States, particularly along the Atlantic seaboard, these wild plants infest the pasture lands to such an extent as to almost ruin the milk supply. Chicory, rag weed and numerous other wayside weeds bother later in the season. Where it is possible to control the access of cows to such places, trouble may be easily prevented."

GREEN MANURING.

The correspondence of the Department for the past year indicates an increasing desire for further information in relation to the use of green crops for fertilizing purposes. Many of these inquiries indicate that those who propound them have rather an indefinite theory as to the action of green crops when turned under; many appear to think that a given weight of green material, no matter from what crop it may be derived, has an equal effect in fertilizing the soil.

It should be remembered that the effect of this kind of manuring is twofold; it has an effect, at least in properly selected crops, of adding phosphoric acid, potash and nitrogen to the surface soil, but it also has a mechanical effect by adding carbon to the soil and making it more porous and easily worked. In some cases, perhaps more than we give it credit for, it has a chemical effect in the formation of acids during its fermentation and decay, and it is to this third effect that we may probably ascribe the deleterious effect which is sometimes reported to the crop immediately following the turning under of green material.

The selection of the crop undoubtedly has much to do with the success or failure of the operations, as there are some crops which can exercise no fertilizing effect at all and the action of which must be entirely ascribed to their mechanical effect. Thus the turning under of a growth of timothy can add nothing but carbon to the soil because this crop obtains all of its phosphoric acid, potash and nitrogen from or near the surface soil, and when turned under merely adds to the soil such portion of these elements as were derived from it, and in the end leaves it none the richer.

On the other hand a crop of the common red clover or of crimson clover, by their deep and fibrous roots, bring a large amount of fertilizing material up from the subsoil, much of which has been carried down below the reach of the roots of the crop, to the building up of the plant and, when turned under, this is added directly to the surface or crop soil. By their power of assimilating the free nitrogen of the air and converting it into forms suitable for plant food, these clovers also add one of the highest priced fertilizing elements to the surface soil.

Another important point, and one often overlooked, is the fact that this mode of adding fertility costs something, and, when compared with other methods, this cost should be taken into account. A crop of clover is worth just what it will bring when converted into some farm product. In dairy districts the unit by which this value may be measured is the product of a cow, either in milk or butter, and the land should be charged with this market value.

If the clover is cut and converted into hay it will produce enough milk and butter, valued at market prices, to much more than buy the phosphoric acid, potash and nitrogen contained in the hay, and in fact enough for a handsome profit on the investment after all the expenses of care of cows, milking, etc., are taken into consideration. This being the case, it naturally follows that there are many districts of our State where it is not economical to turn under a crop of clover, it being more profitable to convert it, by means of cows, into either milk or butter, and after disposing of them purchase the three fertilizing elements named, in the form of a commercial fertilizer or in grain or bran.

Upon the other hand it is equally true that in other parts of our State, where there are not good markets for dairy products, clover may be turned under profitably, but it is a very close question to decide just where the dividing line between these two districts is; to tell just where it will prove profitable as a direct application to the soil, and where the application can be most profitably made through the medium of the cow or other farm stock; and it is in drawing this dividing line that so much loss has ensued in the practice of this mode of enriching the soil.

FEEDING BUTTER-FAT INTO MILK.

The Experiment Station Record gives the following condensed translation from a German author, on the subject of the connection between the food and the amount of butter fat in milk:

"As compared with feeding hay alone, hay and easily digested carbohydrates gave milk poorer in fat. When the hay ration remained practically the same, but large amounts of starch were fed in addition there was no appreciable increase in the milk yield, but a noticeable decrease (about 0.7 per cent.) in the fat. Fourteen pounds of starch was fed with 16 pounds of hay, the starch being treated with malt and given as a sweet drink. The starch is probably changed to body fat but not to milk fat. This agrees with the investigations of Kuhn and Stohmann. Likewise, increasing the amount of protein in the food resulted in an increase of the milk production or prevented a shrinkage with advancing lactation, but gave no one-sided increase in the fat content. The fat content was practically the same when 4 pounds of rice gluten containing 71 per cent. of protein was fed as when hay was fed alone. The addition of fat to hay materially increased the fat content of the milk, provided the fat was in form to be taken up and digested. When sesame oil, linseed oil, or tallow was added to the ration, in the form of emulsions thoroughly mixed with the drinking water, the milk contained as high as 5.8 per cent. of fat. When 1.5 to 2 pounds of linseed oil was added to 18 to 22 pounds of hay the milk averaged 5.24 per cent. of fat for 4 days; when 1 to 2 pounds of tallow was added to the same amount of hay the milk contained from 4.24 to 5.5 per cent. of fat, the average for 8 days being 4.7 per cent.

This is contrary to the results of experiments by M. Fleischer, G. Kuhn and Stohmann. In the latter cases the addition of oil resulted in a slight decrease in the fat, while in the present case it resulted in a material increase in the fat content of the milk. This may be explained by the fact that formerly the oil was mixed with the fodder, in which form it is not digested and causes a disturbance of the digestive functions.

In Fleischer's experiment the addition of 4 pounds of flaxseed resulted in no increase in milk fat because the fat is not digested from whole flaxseed. But in Stohmann's experiment, in which ground flaxseed extracted of fat was fed in place of fat linseed cake, the fat content of the milk decreased from 0.6 to 1 per cent. This is believed to furnish a striking illustration of the effect of a ration poor in fat as compared with one rich in fat. This experiment, made in 1866, has previously been overlooked in discussing this question.

In feeding a ration rich in fat the author believes that the increase in fat content of the milk does not take place by a transmission of the fat of the food to the milk. With such feeding the content of volatile fatty acids in the milk fat decreased in some cases nearly one-half. For instance, the Meissl number dropped from 25.32 to 15.7 when 16 pounds of hay and 2 pounds of sesame oil were fed; and the fat in the milk from cows which were fed 60 to 65 liters of corn distillery slop showed only 15.5 per cent. volatile fatty acids. From this

it might be concluded that the sesame oil and corn oil, which are nearly free from volatile fatty acids, were transmitted to the milk; but if this had been the case the melting point of the butter made from this milk would have been materially decreased. On the contrary, it was considerably increased, being 41.50 degrees, as compared with the average melting point of butter of 36 degrees, while that of the oils is below 0 degree.

As the result of the author's experiments, as well as of the examination of milk from herds to which large amounts of corn-distillery refuse or the residue from the manufacture of starch from corn were fed, it was found, as a rule, that food rich in oil did not give, as was expected, a milk fat with a low melting point, but instead one with an uncommonly high melting point. In other words, such food did not give a soft butter, as is generally stated, but a hard butter instead.

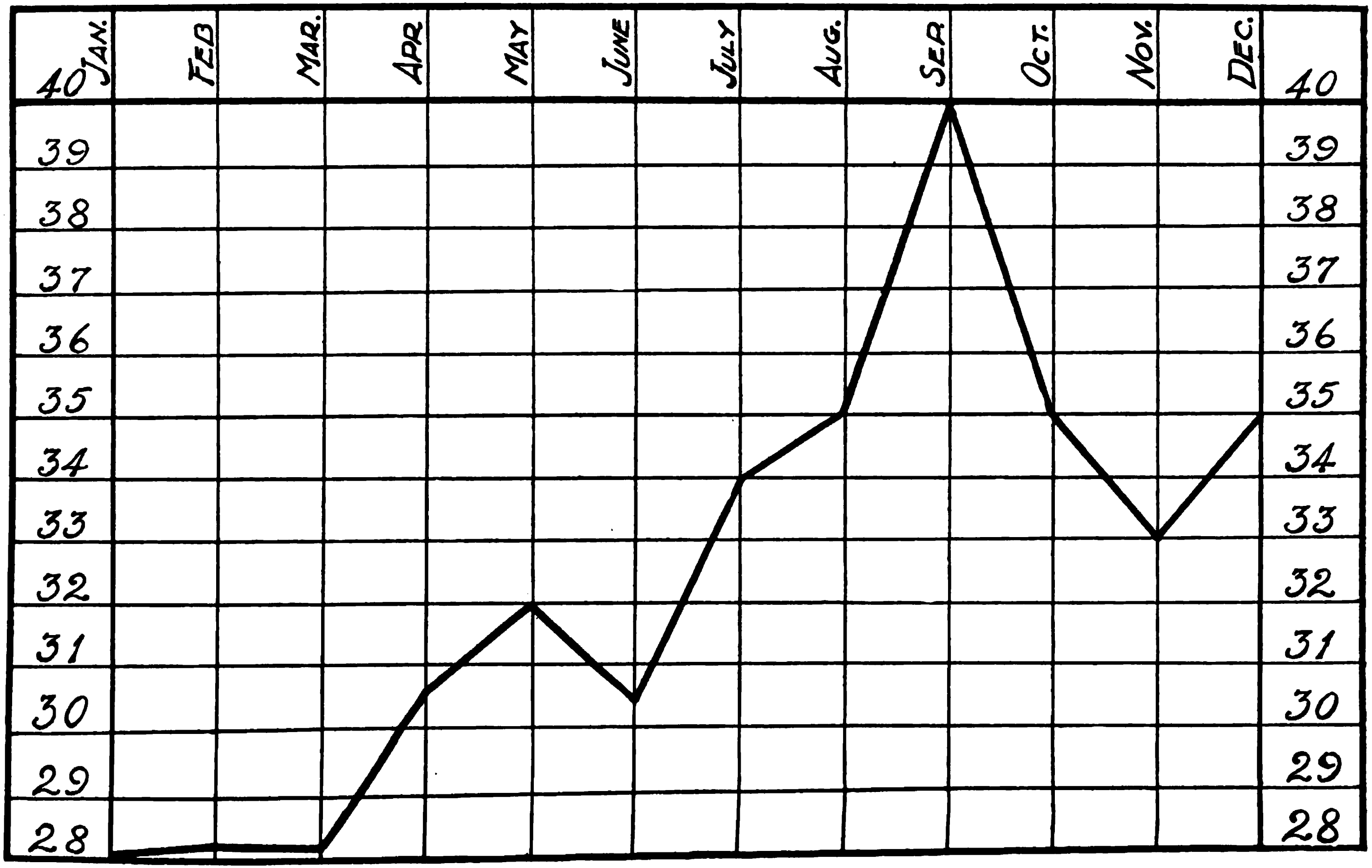
The fat of the food does not go directly into the milk, but forces the milk body fat (that is tallow), and thus indirectly increases the quantity of milk fat. Normal butter fat is certainly a product of the activity of the lacteal glands. Its amount can therefore not be materially increased by the manner of feeding without increasing the secretion of milk as a whole. Unlike the carbohydrates and protein, the fat of the food can materially increase the fat content of the milk, but only by the body fat, produced from the carbohydrates, being transported to the milk whereby the fat of the food is probably consumed to keep up the oxidation in place of the body fat."

SHIPPING APPLES TO ENGLAND.

Hon. George T. Powell, of New York, well known to those who have attended farmers' institutes in the eastern part of our State, in a bulletin of the New York Board of Agriculture, thus alludes to the shipment of apples to England. As Mr. Powell usually markets all of his best fruit in England, his advice may be taken as practical and to the point.

"Ocean freight charges from New York to Liverpool, two shillings and sixpence; to Glasgow, three shillings, English money, per barrel, sometimes less and sometimes more, according to the quantity of freight going over. There is a charge of dock and town dues, and five per cent. commission to be added, that will make the cost from 85 cents to $1.00 per barrel; a little more if shipped to London.

"As soon as the steamer arrives, the different varieties and marks are sorted and they are offered for sale at auction. At the first



PRICES OF CORN AT PHILADELPHIA, 1897.

day's sale they are sold as 'sound.' They are delivered within twenty-four hours after sale, and any barrels in which the apples are loose, called 'slack packed,' and those from which the juice is running, called 'wet,' are sold at the succeeding sale.

"Two barrels of a mark are taken out of the lot, one is opened to show the packing, the other is turned out in baskets or into a large box so that all the fruit in the barrel can be seen. Buyers have an opportunity to inspect samples and obtain a record of the marks before the sale begins. Catalogues being prepared for this purpose, each auctioneer is given a limited amount of time in which to sell his line of goods and frequently, in thirty minutes over 15,000 barrels of apples are sold.

"As soon as fruit is sold the prices are cabled over to the American shippers by some of the firms and checks are forwarded to the shippers promptly, so that returns are made nearly as quickly from foreign markets as from our own.

"Soft summer varieties will not ship well. Dutchess and Twenty-ounce, if picked while hard, will generally sell well. Alexander is too soft. Baldwin, Greening, Spy, King, Spitzenberg, Nonesuch, Newtown Pippin and late Russets are all popular varieties. Jonathans and medium sized apples are especially desired by the London market. Red apples will sell better than green. The Spy is a delicate, tender apple, more difficult to ship, but very much liked when it arrives in good order.

"The heaviest losses that are met with in the export trade come from 'slack packed,' 'wet,' and 'wasty' apples, which have to be sold often below the cost of transportation. Many American shippers pack their fruit exceptionally well, yet meet with heavy losses and charge their English salesmen with having defrauded them, when the real fact is their fruit had a poor keeping quality and slacks in the barrel, went down during the steamer passage, and opened in bad condition on the day of sale. The direct cause for this can be traced to the orchard where the fruit is imperfectly grown, with foliage seriously injured by insects."

REMOVING THE TASSELS FROM THE CORN CROP.

Seven or eight years ago the theory was started that it would be economical to remove a portion of the tassels from corn, the idea being that a portion of the tassels were sufficient to fertilize the whole crop, and that much energy which was usually devoted to the form-

ation of the tassel might be directed to the formation of grain. The first experiment station to institute experiments in this direction was the New York Station at Ithaca, where each alternate row in the large plot had its tassels removed. The figures seemed to show that there was a gain of nearly one half by detasseling. In the succeeding year the matter was taken up by the Ohio Station. In this case the tassels were removed from alternate rows and the result showed that the plots from which the tassels were removed gave 26 per cent. of unmerchantable corn, while the yield of the same kind of corn on the rows on which the tassels had been allowed to remain was but 21 per cent. There was also a loss of about one bushel per acre where the tassels had been taken off.

As a duplicate experiment the tassels upon another plot were left until a later date and then removed, but several experiments of this kind appear to show that the time of removal had but little to do with the result, and failed to check the loss which apparently always followed the process, the result in 1893 showing a loss of three bushels per acre against the detasseling.

The results of a similar test made at the Ohio Station are given in the following table taken from Bulletin No. 78 (April, 1897).

Condition.	Merchantable.	Unmerchantable.	Total.
1891—No. 1, tops left on,	38.5	9.7	48.2
No. 2, tops pulled out August 1,	34.7	11.6	46.3
No. 3, tops left on,	35.1	9.3	44.4
No. 4, tops pulled out August 1,	32.4	12.7	45.1
No. 5, tops left on,	36.0	12.0	48.0
No. 6, tops pulled out August 1,	34.0	14.4	48.5
No. 7, tops left on,	35.4	12.4	47.8
No. 8, tops pulled out,	32.0	12.6	44.6
Average for tops left on,	36.2	10.8	47.0
Average for tops pulled out,	33.2	12.8	46.0
1892—No. 1, tops pulled out July 17,	....	....	77.8
No. 2, tops left on,	....	....	81.4
No. 3, tops pulled out July 17,	....	....	77.3
No. 4, tops left on,	....	....	79.0
No. 5, tops pulled out July 17,	....	....	77.0
No. 6, tops left on,	....	....	80.9
No. 7, tops pulled out July 27,	....	....	79.4
No. 8, tops left on,	....	....	83.7
No. 9, tops pulled out July 27,	....	....	78.7
No. 10, tops left on.	....	....	82.5
No. 11, tops pulled out July 27,	....	....	76.8
No. 12, tops left on,	....	....	78.3
Average from plots with tops pulled out,	....	....	77.8
Average from plots with tops left on,	....	....	80.5

The same bulletin gives the following table showing the average of results from the experiments of ten leading stations with an average of 20 separate tests:

Station.	Total number of tests.	Effect.		
		Crop increased.	No effect.	Crop decreased.
Cornell University,	4	3	1	....
Delaware,	2	2	....	....
Georgia,	1	....	1	....
Illinois,	2	....	1	1
Kansas,	3	1	1	1
Maryland,	1	....	....	1
Nebraska,	2	....	....	2
Ohio,	2	....	1	1
South Carolina,	1	1	....	....
Utah,	2	....	....	2
Totals,	20	7	5	8

CORN SMUT AND ITS PREVENTION.

The annual loss from corn smut is of course not very large in our own State, but in some of the western states having soils better filled with decayed and decaying vegetable matter, the per cent. of actual loss is much greater. It is estimated that the loss to the corn crop in Ohio from smut in 1895 amounted to $125,000.

It has been clearly proven that the spores which cause or produce smut may remain in the soil for a number of years, or until the surrounding conditions are favorable to their growth, and it also appears that they may be carried to the field in the yard manure and that they will pass through the digestive organs of animals without having their vitality the least impaired.

In Bulletin No. 78 of the Ohio Station, Messrs. Selby and Hickman give the following history of the nature and growth of corn smut:

"The smut in corn is a fungous disease, caused by a minute parasitic plant, which grows in the parts where smut boils are afterwards formed. This plant is the corn smut fungus. The smut masses are chiefly the spores of the fungus. These spores serve to spread the smut disease. The spores found in these boils are capable of germinating after they have been kept a long time. If kept dry, they will germinate after many years. It appears that they may pass through the intestines of animals that feed upon the spores and still many of them be capable of growing. There is a further fact

brought out by Brefeld and others: Secondary, yeast-like spores, (conidia) are formed when the spores from the corn germinate in nutrient solutions or in decaying organic matter, such as manure and rotting plants.

"Experiments made in the laboratory by Europeans show that seedling plants may be infected by smut fungi only when the seedlings are very young and tender. That after the plants are older the germ tubes of the smut spores cannot penetrate the plant tissues. It has since been proven that the infection of wheat, oats and barley by smut takes places only with the seedling plants and when these are very young. It was believed for a time that the same was true of corn, but this has since been proven incorrect. While it is apparently true that the smut attacks the seedling corn just as it does the young oats and wheat plants, it does not affect the young seedlings alone nor chiefly. Brefeld has infected all young parts of growing corn plants by conidia produced in liquid cultures. The evidence that this takes place in the corn fields through the secondary spores developed in manure or decayed vegetable matter seems satisfactory. In Brefeld's experiments, the smut boils appeared in from three to six weeks after artificial infection with the spores, and at the point infected. It may be accepted, then, that corn smut is produced wherever infection occurs and that this may be in any young, growing portion of the corn plant, where spores fall upon it.

"The results of Station experiments appear to show that any plan which involves the treatment of the seed corn before planting will fail to produce results; that freshly manured ground is most likely to produce the disease, possibly because the manure contains the spores which produce the smut and which have not been injured by the slight fermentation of the manure or the digestive organs of the animals which have eaten the fodder; that old sods are more likely to produce smut than lighter ones or fallow ground, but that this rule will not hold good in a case where corn follows corn."

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